Southern Little Missouri And Cedar River National Grasslands

Final Oil and Gas Leasing Environmental Impact Statement

Volume 2 of 2

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Custer National Forest
Bureau of Land Management

May 1995

LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS TO WHOM COPIES OF THE DEIS & FEIS WERE SENT

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS TO WHOM COPIES OF THE DEIS & FEIS WERE SENT

Notice of Intent for the Southern Little Missouri and Cedar River National Grasslands Oil and Gas Leasing Environmental Impact Statement was first published in the Federal Register June 27, 1991. The first public scoping letter was issued July 8, 1991, and sent to a mailing list compiled from the Medora Ranger District Range Allotment list, regular District mailing list, and a mailing list obtained from the Custer National Forest Supervisor's Office Public Affairs staff (Documented in Project Files, IDT Meeting Record 4/17/91). A revised Notice of Intent was published in the Federal Register June 16, 1992, with a correction published June 25, 1992. The final amended Notice of Intent was published in the Federal Register December 24, 1992, in conjunction with an amended Scoping Letter sent out December 25, 1992. Responses from these communications were added to the compiled project mailing list.

In December of 1993 a post card mailing was sent to all persons on this mailing list. The card requested a response by January 30, 1994. The results were compiled February 9, 1994. Several late post cards were received and entered, with the last entry taking place April 29, 1994. The following agencies, organizations, and individuals requested that a copy of the **Draft** EIS be sent to them through the above process and additional contacts. Please note that some responses did not request a Draft copy (i.e. receive the ROD only) and therefore are not listed below, however are still on the mailing list to receive other publications from this project.

■ INDIVIDUALS

Name	DEIS	FEIS
Alexander, Randy	X	X
Anderson, Major Dave	X	X
Aslesen, Rosalie V.	X	X
Ayala, Miguel		X
Belodf, Byron J.		X
Bender, William		X
Bentz, Laura N.		X
Bock, Warren	X	X
Bursadt, A		X
Calkins, Burdette (Burt)		X
Carlson, E. John		X
Catron, John	X	X
Cerloneh, Dot		X
Chamberlin, Sydney		X
Cohen, Steve	X	X
Corwin, Betty		X
Davis, Thomas	X	X
Donaldson, Sandra		X
Donovan, Kelly		X
Duxburg, Alexis	X	X
Engen, Corey		X
Farmer, Brian		X
Feist, Lawrence		X
Feist,Randy	X	X
Fox, Lloyd	X	X

Name	DEIS	FEIS
Frazier, Georgia	X	X
Fritz, Charles		X
Fritz, Donna	X	X
Fritz, Rocky	X	X
Gaugler, Bruce A.	X	X
Gaugler, Ralph	X	X
Griffin, Bud	X	X
Hartung, James R.	X	X
Hauson, Clayton		X
Hegland, Dale C.	X	X
Heiser, John A.	X	X
Holcomb, Alice		X
Holden, Dorothy		X
Homiston, Michael	X	X
Hughes, Betty J. (Baker)	X	X
Jaquith, Phillip	X	X
Johnson, Dennis E.		X
Johnson, Michael S.		X
Kampmeyer, Al	X	X
Kantrud, H. Alan		X
Karges, Sue	X	X
Kasson, Bradley M.		X
Kelly, Don H.		X
Krause, Ruby		X
Krein, Kyle Dr.		X

Name	DEIS	FEIS
Kruse, Daniel	X	X
Laflin, F.O.		X
Lang, Jeff	X	X
Martens, JoAnna		X
McCelland, Harriet N.		X
Mittlestadt, Gary L.	X	X
Moffett Sr, William H.		X
Montz, F J		X
Muhlbradt, Bruce		X
Muhlbradt, Karen		X
Natvig, Virgil	X	X
Naze, Dale		X
Nelson, David	X	X
Nelson, Dean D		X
Nilles, Rachel	X	X
Olson, Michael M.		X
Owen, Bruce R.	X	X
Palmer, Richard J.		X
Pearson, Gary L. D.V.M.		X
Perkins, Dexter	X	X
Pietz, Pamela J.		X
Plummer, Doug	X	X
Quale, Brenda	X	X
Ragan, Lee		X
Rare, Harold W.	X	X
Richerson, David	X	X
Rodne, Dean	X	X
Roos, Rev. Arvin W.		X
Roos, Robert J.		X

Name	DEIS	FEIS
Rustand, Steve		X
Sammons, Peggy		X
Sannes, Ron & Margaret		X
Sautner, Don	X	X
Sharp, John	X	X
Solberg, Dustin	X	X
Stennes, Herb		X
Stubblefield, Cindy	X	X
Swanson, John R.	X	
Swenson, Jan	X	X
Syverson, W.D.	X	X
Tescher, Kay		X
Tweten, Marlen	X	X
Van Ningen, Paul C.		X
Vaning, Roger	X	X
Verhulst, Joseph	X	X
Voigt, Theodore		X
Wahlgren, Erwin		X
Wax, Peter		X
Weishaar, Lynn	X	X
Wells, Darrell G.	X	X
West, Paul		X
Wilson, Harry E	X	X
Winess, Paul	X	X
Winter, Norman	X	X
Wolf, Leonard	X	X
Wood, Brian	X	X
Wosepka, Alan	X	X
Younggren, Bob	X	X

■ CORPORATIONS AND AGENCIES

Organization	Attention	DEIS	FEIS
Alliance For Wild Rockies	Jennifer Ferenstein	X	X
Amerada Hess Corporation	Marc Trimmer	X	X
Amerada Hess Corporation	Randy J. Pharr, CPL	X	X
American Wildlands	Robert Ament	X	X
Amoco Production Company	David R. Brown	X	X
Anchor Bay Corporation			X
ANR Production Company	Joe Adamski	X	X
Apache Corporation		X	X
Armstrong Operating Inc.		X	X
Assn of Nationl Grasslands,Inc	Leonard Benson-President	X	X
Assn of Nationl Grasslands,Inc	Sharon K. Bunch, Sec-Treas.	X	X
Assn of Nationl Grasslands,Inc	Vivian Lyon-Vice President	X	X
Audubon Society	Laura Munski		X
AXEM Resources	Paul Brooke	X	X
AXEM Resources Inc	Brook J. Phifer		X
AXEM Resources, Inc.	Mick Homiston	X	X

Organization	Attention	DEIS	FEIS
Basin Elec. Power Cooperation	Bill Cudworth		X
B.H. Badlands & Lakes Assoc	Bill Honerkamp		X
BIA Billings Area Office	Federal Building, 4th Floor	X	X
BIA Fort Berthold Agency	Terry Walters - Superintendent	X	X
BIA Standing Rock Sioux	Charles Murphy, Robert Demery	X	X
Billings County Commission	c/o Auditor	X	X
Bismarck Tribune	Jeff Olson	X	X
Blue Stem, Inc	Nancy Dietz	X	X
Bowman Chamber of Commerce		X	X
Broschat Eng. & Mgmt Services			X
BTA Oil Producers	Tom Tracy	X	X
Buffalo Chamber of Commerce		X	X
Cenex	Corinne Courtney	X	
Cenex Expl. & Production	J.R. Keating		X
Chamber of Commerce		X	X
Consolidated Oil and Gas, Inc	Jerry Sullivan	X	X
Dakota Resource Council	Julie Ruplinger	X	X
Dakota Roughrider Bike Club	Steve Stelton	X	X
Dames & Moore	James Jensen	X	X
Dickinson Press	Attn: Sharon Dietz		X
Dickinson Research Center	Jim Nelson	X	X
Dickinson State University			X
Ducks Unlimited	Paul Bultsma	X	X
Duncan Energy Company	Bruce E. Johnston	X	X
Ebel, Incorp and Associates		X	X
Ecology Center Inc.	William Haskins	X	X
Equitable Resources Energy Co.	Bobbie Schuman		X
Exxon Company, U.S.A	Env/Reg Comp, F. Blackgoat	X	X
Field Director		X	X
Geo. Research Incorporated	Curt Hesla	X	X
Geolinear Company		X	X
Grand Forks Herald	City Editor	X	X
Greystone	Don Douglas	X	X
Harding County			X
Hettinger Chamber of Commerce		X	X
Horse Creek Grazing Assoc.	Richard Malcolm/Robert Lutts	X	X
Ind. Petr. Assc. of Mnt, Sts.	Woodruff, Alex	X	X
Jettison Incorporated		X	X
JN Expl. & Prod. Ltd. Ptrnship	Donna L. Heilser/Gary Nelson	X	X
Kaiser Francis Oil Company	Ruth Summers		X
Koch Oil Company	Eric Mork	X	X
Lemmon Chamber Of Commerce		X	X
Lewis & Clark Wildlife Club	Dick Shaffer		X
Library - Adams County			X
Library - Billings Parmley			X
Library - Bismarck			X
Library - Dickinson			X
Library - Fargo			X
Library - Lemmon			X
Library - Watford City			X
Library - Williston Community			X
Little Hoop Community College	John Toepher, Ph.D.	X	X

Organization	Attention	DEIS	FEIS
Little Missouri Grazing Assoc.	Gail Storlie	X	X
Little Missouri Grazing Assoc.	Lauren Klewin	X	X
Little Missouri Grazing Assoc.	Lauren Klewin	X	X
Little Missouri Grazing Assoc.	Rich Miller	X	X
Little Missouri Grazing Assoc.	Vern Starkes	X	X
LMSRC	Alvin C. Nelson, Chairman	X	X
LMSRC	Einar and Ann Jorgenson	X	X
LMSRC	Harry Turbiville	X	X
LMSRC	Herman Schieffer	X	X
LMSRC	Sidney Connell	X	X
Marathon Oil Company	Pat Childers		X
McKenzie County Commissioners	McKenzie County Court House	X	X
McKenzie Grazing Assoc.		X	X
Medora Chamber of Commerce		X	X
Medora Grazing Association	Randall Mosser	X	X
Medora, Mayor of	James R. Arthaud	X	X
Meridian Oil Company	Eileen Dey/David M. Posage, Englewood, CO	X	X
Meridian Oil Incorporated	Chuck Kaiser, Denver, CO	X	
Miles City Star	Mark Smidt	X	X
Mineral Policy Center	Phil Hocker	X	X
Minerals Exploration Coalition			X
MNE Corp.	Bob Carroll	X	X
Montana State University	Alan R. Harmata		X
Nance Petroleum Corporation			X
National Parks Cons. Assoc.	Lori M. Nelson	X	X
National Wildlife Federation	Cathy Carlson	X	X
National Wildlife Federation	Steve Blomeke/Skip Baron	X	X
National Wildlife Federation	Tom France	X	X
Nature Conservancy	Lynn Alexander	X	X
ND Dept of Health, Water Quality	Jim Collings	X	X
ND Dept of Transportation	David Leftwich	X	X
ND Dept of Univ & Schools	Timothy L. Kingstad	X	X
ND Extension Service	Verm Quam		X
ND External Relations Coordinator		X	X
ND Forest Service	Larry Kotchman		X
ND Game & Fish	Commissioner K.L. Cool	X	X
ND Game & Fish	Jensen, Bill	X	X
ND Game & Fish	Jerry Kobridger	X	X
ND Game & Fish	Ken Sambor	X	X
ND Geological Survey	Tom Heck	X	X
ND Geological Survey	John Hoganson		X
ND Governor Ed Schafer	Governor of North Dakota	X	X
ND Dept. of Health, Air Quality	Dana K. Mount, P.E./Daryl Uram	X	X
ND Industrial Commission	Karline Fine	X	X
ND Industrial Commission	O & G Division - Wes Norton	X	X
ND Natural Heritage Program		X	X
ND Parks & Recreation	Tracy Potter	X	X
ND Petroleum Council	Rocky Mountain O&G Association	X	X
ND Scenic River Commission	Doug Eiken	X	X
ND Secretary of State	Governor of North Dakota	X	X

Organization	Attention	DEIS	FEIS
ND State Historical Society	James Sperry	X	X
ND State Land Dept.	Bob Olheiser	X	X
ND State Land Dept.	Rick D. Larson	X	X
ND State Water Commission	Linda Weispfenning	X	X
ND Wildlife Federation	Rich Cunningham	X	X
North Dakota State University	Dan Hansen	X	X
North Dakota State University			X
Northwoods, Unlimited	Janine C. Webb		X
NRGDC		X	X
Oahe Camp	Troy Hanson	X	X
Orxy Energy Company	Dale Fessler	X	X
Penzoil Expl. & Prod. Co.			X
Petro-Hunt Corporation	Don Nordquist	X	X
Pope & Talbot Incorporated	Bill Coburn		X
Prairie News Journal	Darrel Dorgan		X
Prairie Public Television	Deb Wallwork		X
Public Land Use Consultant	Barbara Mangan	X	X
Public Utilities Commissioner	Dennis Eisnach		X
Quarles Drig. Corporation			X
Reserve Operating Company			X
RMOGA	Claire Mosely	X	X
RMOGA	Lowell Ridgeway	X	X
Rocky Mountain Oil Journal	Roy Boles	X	X
Roosevelt-Custer Region. Cncl.	Rod Landblom	X	X
Rural Development Admin.	Director, Region VII - West	X	X
Sakakawea Pheasants Forever	Steve Hasenwinkel		X
Samson Resources Company	Larry Coshaw		X
Sargent County Teller			X
SD Comm. of Schol & Public Lds	Timothy H. Amdahl	X	X
SD Dept of Comm & Regulation	Mike Mehlhaff	X	X
SD Division of Plant Ind.	Jim Krsnak - Administrator	X	X
SD Governor Walter D. Miller	Governor of South Dakota	X	X
SD Rep. Harvey Krautschun	South Dakota	X	X
SD Representative Elmer Flatt	South Dakota	X	X
SD School of Mines Campus	Dr. Dan Uresk	X	X
SD Secretary of State	Joyce Hazeltine	X	X
SD State University	Flake, Lester D.		X
SD Stockgrowers Association	Darlene Huettl	X	X
Sheyenne Valley Grazing Assoc.	Lynn Wolff	X	X
Sierra Club	John Lamb	X	X
Sierra Club	Kirk Koepsel	X	X
Sierra Club	Wally Owen	X	X
Sierra Club, Agassiz Basin Grp	Dr. L. Winrich	X	X
Sierra Club, Dacotah Chapter	Schafer, Wade	X	X
Sierra Club, Dacotah Chapter	Todd Herreid	X	X
Sierra Oil Corporation	Kerry Hoffman	X	X
Slope County Commission	C/O Auditor	X	X
Standing Rock Game & Fish	DeWight Cook	X	X
Standing Rock Sioux Tribe	Jessy Takenalive - Chairman		X
Stutsman County Wildlife Fed.	Harold A. Kantrud		X
T. Roosevelt Medora Foundation			X
Technco Inc.	Bernell Izard		X

Organization	Attention	DEIS	FEIS
Texaco Expl. & Prod., Inc.	Terry Belton, Denver, CO	X	
Texaco Expl. & Prod., Inc.	D.W. Bowers, Denver, CO	X	X
The Triple T, Inc.	Fred W. Evans	X	X
Three Affliated Tribes	Kyle Baker	X	X
University of North Dakota	Roger W. Sayre	X	X
US Air Force	Barbara Nichols	X	X
US Army Corps of Engineers	Jim Winters	X	X
US Army Corps of Engineers	Richard D. Gorton/Omaha Dist.	X	X
US Bureau of Indian Affairs	Russel Bradley, Standing Rk Ag	X	X
US Congressman Earl Pomeroy	North Dakota	X	X
US Congressman Earl Pomeroy	Ross Keys	X	X
US Congressman Tim Johnson	South Dakota	X	X
US Department of HUD	Howard S. Kutzer	X	X
US DOT, Coast Guard	W.M. McGovern	X	X
US Environ Protection Agency	George Bain, Helena, MT	X	X
US EPA, Off of Envir. Review	Rm. 2119, Mall Attn: Mgmt Info, Washington, DC	X	X
US EPA, Regional VIII	EIS Review Coordinator, Denver, CO	X	X
US Senator Byron Dorgan	Bob Valeu	X	X
US Senator Byron Dorgan	North Dakota	X	X
US Senator Kent Conrad	Lynn Clancy	X	X
US Senator Kent Conrad	North Dakota	X	X
US Senator Larry Pressler	South Dakota	X	X
US Senator Thomas A. Daschle	South Dakota	X	X
USDA APHIS ADC	District Supervisor	X	X
USDA APHIS ADC	State Director	X	X
USDA APHIS ADC	State Director	X	X
USDA Forest Service	North Dakota Coordinator	X	X
USDA Forest Service	Environmental Coor. Chiefs Off	X	X
USDA FS Arap & Roosevelt N.F.	Roger Tarum, Pawnee Nat Grassl	X	X
USDA FS Beaverhead Nat. Forest	Attn: Forest Planner	X	X
USDA FS Bitterroot Nat. Forest	Attn: Forest Planner	X	X
USDA FS Clearwater Nat. Forest	Attn: Forest Planner	X	X
USDA FS Custer Natl. Forest	Chuck Mark	X	X
USDA FS DeerLodge Natl. Forest	Attn: Forest Planner	X	X
USDA FS Flathead Natl. Forest	Attn: Forest Planner	X	X
USDA FS Gallatin Natl. Forest	Attn: Forest Planner	X	X
USDA FS Gallatin Natl. Forest	Bruce May		X
USDA FS Helena Natl. Forest	Attn: Forest Planner	X	X
USDA FS Idaho Panhandle NF	Attn: Forest Planner	X	X
USDA FS Intermountain Region	William B. Miller	X	X
USDA FS Kootenai Natl. Forest	Attn: Forest Planner	X	X
USDA FS Kootenai Natl. Forest	Leslie Ferguson		X
USDA FS Lewis & Clark N.F.	Attn: Forest Planner	X	X
USDA FS Lolo Natl. Forest	Attn: Forest Planner	X	X
USDA FS Lolo Natl. Forest	Fred Stewart		X
USDA FS Nebraska Nat. Forest	Mike Erk, Fall River RD	X	X
USDA FS Nez Perce Natl. Forest	Attn: Forest Planner	X	X
USDA FS Northern Region	Attn: Director of Planning	X	X
USDA FS Ochoco Natl. Forest	Deborah S. Tout	X	X
USDA FS Prescott Natl. Forest	Ray Thompson	X	X
USDA FS Rocky Mountain Region	Larry Jakub, Reg. Attny	X	X

Organization	Attention	DEIS	FEIS
USDA FS Shoshone Natl. Forest	Attn: Forest Planner	X	X
USDA FS Wasatch-Cache NF	Barry Burkhardt	X	X
USDA National Agric. Library	Head, Acquisitions and Serial		X
USDI Bureau of Land Management	Fred Wambolt, Miles City, MT	X	X
USDI Bureau of Land Management	Chuck Wilkie, Worland, WY	X	
USDI Bureau of Land Management	Doug Burger, Dickinson, ND	X	X
USDI Bureau of Land Management	Greg Albright, Billings, MT	X	
USDI Bureau of Land Management	Jake Rajala, Ely, NV	X	
USDI Bureau of Land Management	Peter Ditton, Great Falls, MT	X	
USDI Bureau of Land Management	State Director, Billings, MT	X	
USDI Bureau of Mines	Cochran, William, Denver, CO	X	
USDI Bureau of Mines	Paul Hyndman, Spokane, WA	X	
USDI Federal Highway Admin	Regional Administrator, Lakewood, CO	X	
USDI Fish & Wildlife Serices	Elizabeth H. Stevens, Denver, CO	X	
USDI Fish & Wildlife Service	Helena, MT	X	
USDI Fish & Wildlife Service	Billings, MT	X	
USDI Fish & Wildlife Service	Allyn J. Sapa, State Sup., Bismarck, ND	X	X
USDI Fish & Wildlife Service	Kenneth D. Sanchez, Sacramento, CA	X	X
USDI Fish & Wildlife Service	Merrill S. Zschomler, Pierre, SD	X	X
USDI Fish & Wildlife Service	Roger Collins, Bismarck, ND	X	X
USDI National Park Service	Dale Morlock, Washington, DC	X	
USDI National Park Service	Hart, Pete, Medora, ND	X	X
USDI National Park Service	Robert M. Baker, Denver, CO	X	
USDI Office of Envir. Affairs	Office of Environmental Affair	X	
Vastar Resources, Inc.	Margaret M. Melly		X
Vogel Law Offices	M. Daniel Vogel	X	X
Watford City Chamber of Comm.		X	X
Westech	Pat Farmer	X	X
Wildlife Management Inst, Midwest Rep.	Terry Riley	X	X
Wildlife Society, ND Chapter	Bill Berg/Mike Olson	X	
Wildlife Society, ND Chapter	David Dewald, Bismarck, ND	X	X
Williston Basin Pipeline Co.	Dean Johnson-Safety & Env.Aff.	X	X
Wiser Oil Company			X
Woodward-Clyde Association	Ron Bean	X	X

LITERATURE CITED

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LITERATURE CITED

Allen, G.T., R. Collins, and B. Bicnell. 1988. Gold in the skies. North Dakota Outdoors. June, 50(10): 6-11.

Allen, G.T., and S. Kohn. 1986. The prairie falcon in North Dakota. North Dakota Outdoors. November, 49(4): 2-4.

Allen, W. 1983. Eagle Trapping Along the Little Missouri River. North Dakota History, 50(1).

Anna, L.O. 1981. Ground Water Resources of Billings, Golden Valley, and Slope Counties, North Dakota: North Dakota Geological Survey Bulletin 76, parts II and III, and North Dakota State Water Commission County Ground Water Studies, parts II and III. Documents on file.

Anonymous. 1986. Quality criteria for water 1986. Oil and Grease Section. EPA Publ. 440/5-86-001. 6 pp.

Anonymous. 1981. National Grasslands 1981 information handbook. Manuscript on file. Custer National Forest, Dickinson, North Dakota.

Anonymous. 1968. Water quality cirteria. Rept. to the Sec. of Interior. p. 45-46.

Armstrong, K. Dec. 20, 1993. Letter to D. Sasse, Custer N.F., concerning significant features on Bullion, Pretty, Round Top, Black, Chalky, and White Buttes. From: Kathy Armstrong, Coordinator, Nature Preserve Program, Natural Heritage Inventory, ND Parks & Recreation Dept., Bismarck, 6 pp.

Bailey, R.G. 1983. Delineation of ecosystem regions. Environmental Management. 7(4): 365-373.

Bartuska, A.M. March 8, 1993. USFS Memo: Reply to: 1330-1. Subject: Ecosystem Management definition of principles. To: Regional Foresters, Station Directors, and WO Directors. 3 pp.

Becker, D.M., and C.H. Sieg. 1987. Home range and habitat utilization of breeding male merlins, Falco columbarius, in southeastern Montana. Canadian Field Naturalist. 101: 398-403.

Beckes, M. and J. Keyser. 1983. The prehistory of Custer National Forest: an overview. Custer National Forest, Billings, MT.

Benninger-Truax, M., J.L. Vankat, and R.L. Schaefer. 1992. Trail corridors as habitat and conduits for movement of plant species in Rocky Mountain National Park, Colorado, USA. Landscape Ecology, 6(4): 269-278.

Bighorn Sheep Study Project Advisory Committee. June 1993. Memorandum to D. Burger/BLM & S. Redfern/ USFS on Bighorn Sheep Study.

Bihrle, C. 1988. Walkabout elk. North Dakota Outdoors. June. 50(10): 14-15.

Bilderback, D.E. 1987. A Baseline Study of Bryophytes in relation to Air Quality in Theodore Roosevelt National Park. University of Montana.

Bishop, N.G., and J.L. Culbertson. 1976. Decline of prairie dog towns in southwestern North Dakota. J. Range Manage. 29(3): 217-220.

Bjornn, T.C. 1973. Survival and emergence of salmon and trout embryos and fry in gravel-sand mixtures. Unpubl. Rept. Univ. of Idaho.

Bjornn, T.C., M.A. Brusven, M. Molnau, F.J. Watts, R.L. Wallance, D.R. Nelson, M.F. Sandien and L.C. Stuehrenberg. 1974. Sediment in streams and its effects on aquatice life. Tech, Compl. Rept. Water Resour. Res. Int. Proj. B-025-IDA. Univ. of Idaho. 43 pp.

Blake, J.G., G.J. Niemi, J.M. Hanowski. 1989. Drought and annual variation in bird populations. pp. 419-430. *In* Hagan, J.M. III, and D.W. Johnston. 1989. Ecology and conservation of neotropical migrant landbirds. Symposium Held Dec. 6-9, 1989, Woods Hole, Mass., and hosed by the Manoment Bird Observatory. Smithsonian Institution Press, Washington, D.C., 609 pp.

Bluemle, J.P., 1988. Geologic Highway Map of North Dakota, Scale: 1":10 miles.

Bluemle, J.P. 1977. The Face of North Dakota, The Geologic Story. Educational Series 11, NDGS.

Blumer, M. 1970. Oil contamination of the living resources of the sea. FAO Tech. Conf. Rome. FIR:MP/70/R-1, 11 pp.

Boldt, C.E., D.W. Uresk, and K.E. Severson. 1978. Riparian woodlands in jeopardy on the northern high Plains. *In* Strategies for Protection and Management of Floodplain Wetlands and other Riparian Ecosystems. National Symposium, Callaway Gardens, Atlanta, Georgia, Dec. 11-13, 1978. p. 184-189.

Borchert, J., D. Klinner and L. Loendorf. 1991. The Pretty Butte Site, 32SL100. Ms. on File, Custer National Forest, Billings, MT.

Bowers, A. 1950. Mandan Social and Ceremonial Organization. University of Chicago Press. Chicago, Illinois.

Brown, G.W. 1969. Predicting temperature of small streams. Water Resour. Res. 5(1): 68-75.

Brown, R.W. 1971. Distribution of plan communities in the southwestern Montana badllands. American Midland Naturalist. 75(2): 457-477.

Butler, J. and H. Goetz. 1984. Influence of livestock on the composition and structure of green ash communities in the northern Great Plains. *In* Wooded Draws: Characteristics and Values for the Northern Great Plains. Symposium Proceedings, South Dakota School Mines and Technology, Rapid City, June 12-13, 1984. p. 44-49.

Calkins, B. 1995. Back in the badlands. Bugle 12(1): 93-101.

Call, M.W., and C. Maser. 1985. Wildlife habitats in managed rangelands - the Great Basin of southeastern Oregon: Sage grouse. USDA, USFS, Gen. Tech. Rep. PNW-187. 30 pp.

Carlson, C.G. 1983. Geology of Billings, Golden Valley, and Slope Counties, North Dakota, North Dakota Geological Survey Bulletin 76 - Part 1, 1983.

CEQ, 1993. Incorporating biodiversity considerations into environmental impact analysis under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President, 722 Jackson Place, NW, Washington, D.C. 20503. Jan. 1993. 29 pp.

Christensen, A.G., L.J. Lyon, J.W. Unsworth. 1993. Elk management in the Northern Region: considerations in forest plan updates or revisions. Gen. Tech. Rep. INT-303. Ogden, UT: USDA, USFS, Intermountain Research Station. 10 pp.

Clark, W.F. May 1993. 40 years of fires on the Custer National Forest 1953 through 1992. A complete log of all the recorded fires in those 40 years and summaries and analyses of those fires. USDA USFS, Custer National Forest. 96 pp.

Clark, W.F. 1982. Custer National Forest Lands. A Brief History. Ms. on File, Custer National Forest, Billings, MT.

Clayton, L., C.G. Carlson, W.L. Moore, G. Groenewold, F.D. Holland Jr., and S.R. Moran. 1977. The Slope (Paleocene) and Bullion Creek (Paleocene) Formations of North Dakota, North Dakota Geological Survey Report of Investigation No. 59, 1977.

Cline, R., G. Cole, W. Megahan, R. Patten and J. Potyondy. 1981. Guide for predicting sediment yields from forested watersheds. USDA-Forest Service Region 1 and 4. 48 pp.

Collins, R. March 14, 1995. FAX of list of Federal Threatened, Endangered and candidate species found in North Dakota, November 1994. To: Don Sasse, USFS, Custer N.F., Billings, MT, From: Roger Collins, USFWS, Bismarck, ND. 2 pp.

Collins, R. 1993. Personal communication to D.Sasse confirming USFWS species list.

Crawford, L. 1925. The Medora-Black Hills Stage Line. North Dakota Historical Society Collections. 7: 307-323.

Cully, J.F., Jr. 1989. Plague in prairie dog ecosystems; importance for black-footed ferret management. pp. 47-55, *In* Clark, T. W., D. Hinckley, and T. Rich. 1989. The prairie dog ecosystem: managing for biological diversity. Montana BLM Wildlife Technical Bulletin No. 2, August 1989., Billings, MT, 55 pp.

Cvancara, A.M. 1976. Geology of the Cannonball Formation (Paleocene) in the Williston Basin, With Reference to Uranium Potential, North Dakota Geological Survey Report of Investigation No. 57.

Deaver, S. and A. Manning. 1992. Draft Ethnographic Overview of the Mckenzie, Medora, Sioux, Ashland and Beartooth Ranger Districts of the Custer National Forest. Ms. on File, Custer National Forest, Billings, MT.

Department of the Army, Corps of Engineers. Omaha District. Analysis of U.S. Geological Survey suspended sediment data. pp. 1-21.

Dobkin, D.S. 1992. Neotropical migrant landbirds in the Northern Rockies and Great Plains. USDA., Forest Service, Northern Region. Publication No. R1-93-34. Missoula, MT. 203 pp.

Dueholm, K.H. 1993. Results of a botanical survey of the Bullion Butte area of Billings and Golden Valley Counties, North Dakota. North Dakota Natural Heritage Inventory, North Dakota Parks and Recreation Department, Bismarck. Prepared for USFS, Medora RD, Custer NF, Sierra Club, and Meridian Oil Co. November 1993. 7 pp.

Duerre, D. 1986. The Little Missouri River Fishery. Unpublsihed Rep., North Dakota Game and Fish Dept. 5 pp.

Duerre, D. 1973. Cannonball River Basin. Unpublished Rept., North Dakota Game and Fish Dept. 5 pp.

Egoscue, H. J. 1979. Vulpes velox (swift fox). Mammalian Species No. 122, The American Society of Mammalogists. pp. 1-5

Evans, W.L., February 18, 1969. USFS Memorandum: Reply to 5510 Modification, Subject: Cedar River National Grasslands, To: Regional Forester, 1 p.

Faanes, C. 1984. Wooded islands in the sea of prairie. American Birds 38(1): 3-6.

Faanes, C. 1983. Breading birds of wooded draws in central North Dakota. Prairie Naturalist 15(4): 173-187.

Friedlander, J. May 17, 1993. Mountain Plover. Internal message, USFS-Region 2, 1 p.

Frison, G. 1976. Prehistoric Hunters of the High Plains. Academic Press, New York.

Gaines, E.P., and M.R. Ryan. 1988. Piping plover habitat use and reproductive success in North Dakota. J. Wildl. Manage. 52(2): 266-273.

Gaines, R.C. 1985. Nest site selection, habitat utilization, and breeding biology of the ferruginous hawk in central North Dakota. M.S. Thesis. NDSU. Fargo, ND. 32 pp.

George, T.L., A.C. Fowler, R.L. Knight, and L.C. McEwen. 1992. Impacts of a severe drought on grassland birds in western North Dakota. Ecological Applications 2(3): 275-284.

Gerhard, L.C., S.B. Anderson, J.A. Lefever, and C.G. Carlson. 1982. Geological development, origin, and energy mineral resources of the Williston Basin, North Dakota, North Dakota Geological Survey, Miscellaneous Series 63, p. 989-1020.

Gilmer, D. S., and R. E. Stewart. 1983. Ferruginous hawk populations and habitat use in North Dakota. J. Wildl. Manage. 47: 146-157.

Girard, M.M. 1985. Native woodland ecology and habitat type classification of southwestern North Dakota. PHD Dissertation. North Dakota State Univ., Fargo. 72, 247 p.

Girard, M.M., H. Goetz, and A.J. Bjugstad. 1987. Factors influencing woodlands of southwestern North Dakota. Prairie Nat. 19(3): 189-198.

Goosen, J.P., S. Brechtel, K.D. De Smet, D. Hjertaas, and C. Werschler. April 1993. Canadian Baird's sparrow recovery plan. Recovery of Nationally Endangered Wildlife, RENEW Report No. 3, Ottawa: Canadian Wildlife Federation. 28 pp.

Gray, J.P. May 21, 1993. Identification of the Tracy Mountain - Moody Plateau and the Bullion Butte-Ponderosa Pine area as used in the Forest Plan, USDA, Custer NF. 10 pages.

Gray, J.S. 1976. The Sioux war of 1876, centennial campaign. Old Army Press.

Green, J.M. 1960. The Dakota National Forest. Masters Thesis, North Dakota Agricultural College.

Griffin, S.L. 1991. Pronghorn use of agricultural land in northwestern South Dakota. M.S. Thesis, South Dakota State University.

Grondahl, C.D. 1993. Bighorn country. North Dakota Outdoors. June. 60(10): 14-19.

Grondahl, C.D. 1988. Piping plovers,onion cups, and the drought of '88. North Dakota Outdoors. June. 51(4): 12-14.

Guenther, D. 1993. Little Missouri National Grasslands rare plant survey 1993. Prepared for USFS, Medora R. D., Custer N. F., ND. Prepared by North Dakota Natural Heritage Inventory, ND Parks and Recreation Department, Sept. 1993.

Hansen, P., K. Boggs, R. Pfister, and J. Joy. Aug. 1991. Classification and management of riparian and wetland sites in Montana. DRAFT Version 1. Montana Riparian Association, Montana Forest and conservation Experimental station, School of forestry, University of Montana, Missoula. 478 pp.

Hansen, P.L., G.R. Hoffman, and A.J. Bjugstad. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: A habitat classification. General Technical Report RM-113, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 35 pp.

Harmata, A.R. 1991. Impacts of oil and gas development on raptors associated with Kevin Rim, Montana. Kevin Rim Raptor Study Group, Biology Dept. MSU, Bozeman. 78 pp.

Heck, T.J., 1992. Oil exploration and development in the North Dakota Williston Basin: 1990-1991 update, North Dakota Geological Survey Miscellaneous Series No. 77, 26 pp.

Hermanson, J.W. and T.J. O'Shea. 1983. Antrozous pallidus (Pallid bat). Mammalian Species No. 213, The American Society of Mammalogist. pp. 1-8.

Higgins, K.F. 1984. Lightning fires in North Dakota grasslands and in pine-savanna lands of South Dakota and Montana. J. Range Manage. 37(2): 110-103.

Hoffbeck, S.R. 1991. Sully Springs, Saga of a Badlands Railroad Settlement. North Dakota History, 58(3): 16-31.

Hoganson, J.W. 1993. North Dakota Geological Survey Paleontologist, personal communication, April 30 and May 4, 1993.

Hoganson, J.W. 1993. Paleontological Sites Located On or Near United States Forest Service Lands in North Dakota, North Dakota Geological Survey, 1987, updated 1993. Document on file.

Hopkins, R.B. 1984. Avian species associated with prairie woodland types. *In* Wooded Draws: Characteristics and Values for the Northern Great Plains. Symposium Proceedings, South Dakota School Mines and Technology, Rapid City, June 12-13, 1984. p. 27-35.

Jefferis, L. 1993. Reasonably Foreseeable Development Scenario, Southern Little Missouri Oil and Gas Leasing EIS. Project file for EIS, Custer National Forest, Billings, MT.

Jensen, B. March 11, 1994. TO: Don Sasse, USFS, FROM: Bill Jensen NDGFD, RE: Requested information on Bighorn Sheep (Magpie and Sheep Cr. Herd). Quarter sections where lambs have been sighted. 9 pp.

Jensen, B. Jan. 25, 1994. TO: Big Game Staff, FROM: Bill Jensen RE: Summary of 1992 bighorn sheep incidental observations (Little Missouri National Grasslands). NDGFD Internal Memo. 2 pp.

Jensen, B. December 6, 1993. Memo To: Mike McKenna, From: Bill Jensen, NDGFD, RE: Golden eagles on the Little Missouri National Grasslands. 4 pp.

Jensen, B. July 6, 1993. RE: Boundaries of bighorn sheep study area. To: Whom it may concern. NDGFD, Bismarck, (Internal Memo), 8 pp.

Jensen, B. Sept. 28, 1992. Evaluation of potential bighorn sheep release sites on the Little Missouri National Grasslands. NDGFD, (Draft Internal Report), 19 pp.

Jensen, B. June 11, 1992. Subject: status of five research natural areas within the Dakota's EIS project area. To: Jim Gray, Supervisor's Office, Custer N.F., Billings, From: Bill Jensen, Medora RD, USFS, Dickinson. 12 pp.

Jensen, B. December 1988. Summer and Fall Ecology of Mule Deer in the North Dakota Badlands. University of North Dakota Philosophy Dissertation.

Jensen, B. and K. Sambour. Dec. 8, 1992. To: Greg Visconty, U.S. Forest Service, From: Bill Jensen and Ken Sambour, NDGFD, RE: History of the canyon lands complex stipulation (1984-1992). 4 pp.

Jensen, M.E., and P.S. Bourgeron. 1993. Eastside Forest Ecosystem Health Assessment, Volume II Ecosystem Management: Principles and Applications - An implementation framework for ecosystem management. April USDS, USFS, Forest Service Research, Northern Region, Missoula, MT 397 pp.

Jensen, W.F. 1991. Historical frequency of drought in western North Dakota (1406 to 1990). North Dakota Game and Fish Dept., Bismarck (Internal Memo), 12 pp.

Jensen, W. F., Nov. 14, 1994. Letter to: Don Sasse (USFS, Billings, MT), From: Bill Jensen, (NDGFD, Bismarck), regarding revised maps denoting isolated clay knobs (windbreaks) in pronghorn winter range, SLM EIS. 1 pp.

Johnson, D.W. 1986. Desert Buttes: Natural experiments for testing theories of island biogeography. National Geographic Research. 2: 152-166.

Johnson, M., and J. Knue. 1989. Feathers from the prairie: a short history of upland game birds. North Dakota Game and Fish Department, Bismarck. Quality Printing, Bismarck. 292 pp.

Jolly, D.F. 1992, and C. Bates. 1993. Letter from Jolly on Activity in Roadless Areas and Letter from Bates on North Dakota Wilderness Proposal.

Kannowski, P.B. Sept. 8, 1994. Letter to: Donald C. Sasse, Custer National Forest, Billings, MT, From: Paul B. Kannowski, Ph.D., THE PRAIRIE NATURLIST, P.O. Box 9019, Grand Forks, ND 58202-9019, concerning Belfragi's chlorochroan bug (Chlorochroa belfragii). 5 pp.

Kelsch, S. 1993. Survey of the fishes of the Little Missouri River from Marmarth to Medora, North Dakota. 24 pp.

Knopf, F.L. 1993. Conserving biological diversity. Unpublished. National Biological Survey, Fort Collins, CO, 2 pp.

Knowles, C.J. 1986. Some relationships of black-tailed prairie dogs to livestock grazing. Great Basin Naturalist. 46(2): 198-203.

Knowles, C.J. Nov. 5, 1992. Status and distribution of mountain plovers in Montana (abstract). Montana Rare Animal Meeting, November 5-6, 1992. Lewistown, Montana.

Knowles, C.J., and P.R. Knowles. Feb. 9, 1993. Mountain plover numbers, reproduction, and habitat use in three areas of Montana. Prepared for BLM, Montana State Office, Billings, by FaunaWest Wildlife Consultants, P.O. Box 113, Boulder, MT 59632. 34 pp.

Knowles, C.J., and P.R. Knowles. 1984. Additional records of mountain plovers using prairie dog towns in Montana. Prairie Nat. 16(4): 183-186.

Knowles, C.J., C.J. Stoner, and S.P. Gieb. 1984. Selective use of black-tailed prairie dog towns by mountain plovers. Condor 84: 71-71.

Knue, J. 1991. Big game in North Dakota: a short history. NDGFD, Bismarck, 343 pp.

Kohm, K. 1991. Balancing on the brink of extinction: the Endangered Species Act and lessons for the future. Island Press, Washington D. C., 318 pp.

Konrad, P. M., and D. S. Gilmer. 1986. Post fledging behavior of ferruginous hawks in North Dakota. Raptor Research 20(1): 35-39.

Kuehn, D. 1990. The Archaeology of Theodore Roosevelt National Park, North Dakota:Final Results of the 1987-1989 University of North Dakota Investigations. Contribution No. 257, University of North Dakota, Grand Forks.

Kunz, T. H., and R. A. Martin. 1982. Plecotus townsendii (Townsend's big-eared bat). Mammalian Species No. 175, The American Society of Mammalogists. pp. 1-6

Laycock, W.A. 1989. History of grassland plowing and grass planting on the Great Plains.

Lenz, D. 1993. 1991-1992 inventory of rare plant species in the Little Missouri National Grasslands, Billings, Slope, and Golden Valley Counties, North Dakota. North Dakota Natural Heritage Program, North Dakota Parks and Tourism, Bismarck, North Dakota, for USFS, Custer N. F., Billings, MT, June 1993. 72 pp.

Leonard, M. L., and M. B. Fenton. 1983. Habitat use by spotted bats (Euderma maculatum), Chiroptera: Vespertilionidae): roosting and foraging behaviour. Can. J. Zool. 61: 1487-1491.

Licht, D.S., and K.D. Sanchez. 1993. Association of black-tailed prairie dog colonies with cattle point attractants in the Northern Great Plains. Great Basin Naturalist 53(4): 385-389.

Lokemoen, J. T., and H. F. Duebbert. 1976. Ferruginous hawk nesting ecology and raptor populations in northern South Dakota. Condor 78: 464-470.

Lyon, L. J., A.G. Christensen. 1992. A partial glossary of elk management terms. Gen. Tech. Rep. INT-288. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 6 p.

Mark, C.A. July 28-30 1992. Personal observation, silviculturist, Custer N.F.

May, B. Feb. 9, 1994. An aquatic ecological assessment associated with the Southern Little Missouri Oil and Gas Leasing EIS with Special Reference to the Fish Fauna within the Little Missouri River Basin, Medora and Grand River Districts, Custer National Forest. (Internal USFS memo) 16 pp.

MBEWG. 1991. Habitat Management Guide for Bald Eagle in Northwestern Montana, Montana Bald Eagle Working Group, 29 pp.

McCarthy, C. March 22, 1993. Reply to: 2630, Subject: Meeting with North Dakota Game and Fish Department, To: Forest Supervisor, 5 pp.

McKee, J.E. and H.W. Wolf. 1963. Water quality criteria. Res. Agency of Calif. Publ. 3-A. p. 229-232.

McKenna, M.G. June 16, 1993. Letter to Mr. Don Douglas, Greystone, Englewood, CO, regarding wildlife resources in the Fryburg Oil Field Expansion EA area, from Michael G. Mckenna, Chief, Natural Resources Division, NDGFD, Bismarck, ND, 3 pp.

McKenna, M.G. Jan. 21, 1994. Letter to Rodd Richardson, Acting Forest Supervisor, Custer N.F., From: Michael G. McKenna, Chief, Natural Resources Division, NDGFD, RE: Canyonlands (mule deer habitat). 1 pp.

McKenzie, J.V., J. Samuelson, and R. Johnson. October 1993. Deer population studies. North Dakota State Game and Fish Department, Pitman-Robertson Division, Study No. C-I, Project W-67-R-33. Report No. A-108, 22 pp.

Medlin, J.A. Dec. 8, 1993. Letter to R. Richardson, Acting Forest Supervisor, Custer N. F., From USFWS, Ecological Services, Bismarck, ND State Office, regarding clarification on prairie dog towns and potential black-footed ferret reintroduction areas. 2 pp.

Meehan, W.R, F.J. Swanson and J.R. Sedell. 1977. Influence of riparian vegetation of aquatice ecosystems with particular reference to salmonid fishes and their food supply. In: Importance, preservation and management of riparian habitat. Gen. Tech. Rep. RM-43. USDA-Forest Service. pp. 137-145.

Meridian Oil Company. Undated. Environmental Assessment Pierre Creek Field, McKenzie County, North Dakota.

Mertes, J.D. 1978. Criteria for selecting lands that are not to be disturbed. *IN* Reclamation of Drastically Disturbed Lands. p 205-221.

Milburn, S., July 1993. Background Information for Proposed North Dakota Wilderness Areas. USDA Forest Service, Billings, MT. 22 pages.

Mitchell, J.E. and R.H. Hart. 1987. Winter of 1886-1887: the death knell of open range. Rangelands 9: 3-8.

Moffat, M., and N. McPillips. 1993. Management for butterflies in the northern great plains: a literature review and guidebook for land managers. USFWS, Ecological Services, Pierre, SD, March 1993, 19 pp.

Moll, J.E. 1993. Environmentally sensitive roads. Engineering Field Notes, Engineering Technical Information System. U.S. Dept. of Agriculture, Forest Service, Washington, D.C., Vol. 26. p. 21-27.

Mumma, J.W. June 5, 1991. Updated listing of sensitive plants, animals in (Northern) Region National Forests. News release R1:2267, 3 pp.

Murphy, E.C., J.W. Hoganson, and N.F. Forsman. 1993. Geology of Bullion and Black Buttes. *IN* The Chadron, Brule, and Arikaree Formations in North Dakota. Report of Investigation No. 96, North Dakota Geological Survey, John P. Bluemle, State Geologist. p. 29-32, 62-65, plate 2.

Naiman, R.J., and J.R. Sedell, 1979 Benthic organic matter as a function of stream order in Oregon. Arch. Hydrobiol. 87(4): 404-422.

NDNSS. April 1993. North Dakota Natural Science Society Newsletter, 10(2): 3.

ND Petroleum Council. 1994.

Norsven, E. July 30, 1991. Forestry Technician for the Custer National Forest. Letter to Mike Matozevich. Northern Little Missouri EIS.

North Dakota State Department of Health and Consolidated Laboratories. December 1994. Harmon, Daniel E. written response from telephone request on air quality monitoring.

North Dakota State Department of Health and Consolidated Laboratories. April 1992. North Dakota Air Quality Monitoring Data Summary 1991. Air Quality Monitoring Branch Division of Environmental Engineering. pp. 3, 4, 7, 8.

North Dakota State Department of Health and Consolidated Laboratories. 1990. Division of Water Supply and Pollution Control. The Status of Water Quality in the State of North Dakota, 1988-1989. 73 pp. (page 1-73)

North Dakota State Department of Health and Consolidated Laboratories. June 1990. North Dakota Air Pollution Control Law.

North Dakota State Department of Health and Consolidated Laboratories. North Dakota Air Pollution Control Rules 33-15-01 through 33-15-20. pp. 17-1, 19-1.

North Dakota State Game and Fish Department. August 5 & 6, 1993. Personal communication.

North Dakota (State of). North Dakota Administrative Code, Rules and Regulations, Chapter 43-02-03-19, pp. 8, 18.

North Dakota Geological Survey. 1991. The petroleum potential of the Little Missouri National Grasslands.

Noss, R.F. 1989. Implications of landscape concepts for the management of biodiversity. *In* Wildlife Diversity and Landscape Patterns in Northwest Coastal Forests. Workshop, Sept. 14-15, 1989. p. 5-6.

Noss, R.F. 1983. A regional landscape approach to maintain diversity. BioScience, Vol. 33, No. 11, pp. 700-706.

Odum, E.P. 1971. Fundamentals of ecology. 3nd edition. W.B. Sounders Co., Philadelphia. 574 pp.

O'Gara, B.W., and J.D. Yoakum, eds. 1992. Pronghorn management guides. Pronghorn Antelope Workshop, Rock Springs, Wyoming, 101 pp.

Oldemeyer, J.L., D.E. Biggins, B.J. Miller, and R. Crete (editors). 1993. Proceedings of the Symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. USDI, USFWS, Biological Report 13, July 1993. 97 pp.

Olendorff, R.R. 1993. Status, biology, and management of ferruginous hawks: a review. Raptor Res. and Tech. Asst. Cen., Spec. Rept. U.S. Dep. Interior, Bur. Land Manage., Boise, Id. 84 pp.

PAMA-NDGFD. August 1992. PAMA: North Dakota Game and Fish Department's Participative Management Process. NDGFD, 100 North Bismarck Expressway, Bismarck, ND, 58501-5095. 140 pp.

Personius, R.G, and S. Eddy. 1955. Unpublished Report, date unknown. surveys of fish fauna in the Little Missouri River. Copeia (1): 41-43.

Peterka, J.J. 1993. Survey of fishes in the Little Missouri and Knife Rivers, and in Spring Creek in southwestern North Dakota, 1993. Unpublished Rept. 14 pp.

Pfaller, L. 1954. The Fort Keogh to Bismarck Stage Route. North Dakota History, 21(3): 91-125.

Platts, W.S., et al. February 1987. Methods for Evaluating Riparian Habitats with Applications to Management. USDA, USFS, Intermountain Research Station, General Technical Report INT-221. pg 99. (page 1-177)

Potter, L.D. 1952. North Dakota's heritage of pine. North Dakota History. 19(3): 1-11. (Published by: State Historical Society of North Dakota, Bismarck)

Potter, L.D., and D.L. Green. 1964. Ecology of ponderosa pine in western North Dakota. Ecology 45(1): 10-23.

Potter, L.D., and Green, D.L. 1964b. Ecology of a northeastern outlying stand of Pinus flexilis. Ecology 45(4): 866-868.

Prose, B.L. 1987. Habitat suitability index models: plains sharp-tailed grouse. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.142). 31 pp.

Reel, S., L. Schassberger, and W. Ruedier. 1989. Caring for out natural community: Region 1 - Threatened, Endangered, and Sensitive Species program. USDA, Forest Service Northern Region. 310 pp. Document on File

Reigh, R.C. 1978. Fishes of the western tributaries of the Missouri River in North Dakota. M.S. Thesis. Univ. of North Dakota. 200 pp.

Richter, S., (Editor). 1993. Badlands On The Brink: North Dakota Wilderness and Wild and Scenic River Proposal, Teddy Roosevelt Group of the Sierra Club, Mandan, ND. 23 pp.

Risbrudt, C. June 10, 1994. USFS memo. Reply to: 2670. Subject: Update of Northern Region sensitive species list (1994). To: Forest Supervisors. From: Christopher D. Risbrudt for David F. Jolly, Regional Forester. 14 pp.

Risser, P.G. 1988. Diversity in and amoung the grasslands. pp. 176-180, In: Wilson, E.O. (Editor) and F. M. Peter (Assoc. Editor). 1988. Biodiversity. National Academy Press, Washington, D.C. 521 pp.

RMRCC. 1989. Uniform Format for Oil and Gas Lease Stipulations. Rocky Mountain Regional Coordinating for USDI, BLM, USFS. Committee, March 1989. 16 pp.

Robertson, F.D. June 4, 1992. USFS Memo: Reply to 1330-1. Subject: Ecosystem management of the National Forests and Grasslands. To: Regional Foresters and Station Directors. 8 pp.

Robinson, E.B. 1966. History of North Dakota, University of Nebraska Press, Lincoln.

Robinson, S.K., J.A. Grzybowski, S.I. Rothstein, M.C. Brittingham, L.J. Petit, and F.R. Thompson. 1992. Management implications of cowbird parasitism on neotropical migrant songbirds. *In* Status and Management of Neotropical Migratory Birds. Gen. Tech. Rep. RM-229. U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO, Sept. 21-25, 1992. 422 pp.

Rost, G.R. and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. J. Wildl. Manage. 43(3): 634-641.

Royer, R. A., and G. M. Marrone. 1992a. Conservation status of the regal fritillary (Speyeria idalia) in North and South Dakota. Report to the U.S. Departement of Interior, Fish and Wildlife Service, Region 6. 44 pp. and appendicies.

Royer, R. A., and G. M. Marrone. 1992b. Conservation status of the Dakota skipper (Hesperia dakotae) in North and South Dakota. Report to the U.S. Departement of Interior, Fish and Wildlife Service, Region 6. 44 pp. and appendicies.

Royer, R. A., and G. M. Marrone. 1992c. Conservation status of the tawny crescent (Phyciodes batesii) in North and South Dakota. Report to the U.S. Departement of Interior, Fish and Wildlife Service, Region 6. 34 pp. and appendicies.

Royer, R. A. 1988. Butterflies of North Dakota - An atlas and guide. Minot State University, ND, Science Monograph No. 1, 192 pp.

Royer, R. 1987. Dakota's rare namesake butterfly. North Dakota Outdoors. July, 50(1): 8-10.

Rumble, M. A. 1992. Roosting habitat for Merriam's turkeys in the Black Hills, South Dakota. J. Wildlife Management 56(4): 750-759.

Samson, F.B., and F.L. Knopf. 1993. In my opinion ... Managing biological diversity. Wildl. Soc. Bull. 21: 509-514.

Samuelson, J. NDFGD. June 1993. Bighorn sheep population studies. North Dakota State Game and Fish Department, Pitman-Robertson Division, Study No. C-III, Project W-67-R-33. Report No. A-110, 16 pp.

Samuelson, J. July 1993. American pronghorn population study. North Dakota State Game and Fish Department, Pitman-Robertson Division, Study No. C-II, Project W-67-R-33. Report No. A-109, 22 pp.

Sapa, A.J. April 22, 1992. Letter to C. W. Bates, Forest Supervisor, Custer N. F., From USFWS ND State Office, regarding USFS requested list of Federally listed threatened and endangered species. 4 pp.

Sasse, D. March 31, 1993. Internal USFS Memo To: Cheri Bashor, RNA Coordinator, Custer NF. Subject: Research Natural Areas and Special Interest Areas on the Little Missouri National Grasslands (summary of existing information). From: D.Sasse. SO Planning. File 4060. 39 pp.

Sayre, R.W. September 21, 1994. Letter to: Nancy Curriden, Forest Supervisor, Custer National Forest, From: Roger W. Sayer, Graduate Research Student, Univ. of ND, Grand Forks, ND. RE: Comments on SLM DEIS (June 1994) regarding bighorn sheep. 3 pp.

Sayre, R. January 23, 1994. Letter from: R. Sayer, University of North Dakota, Grand Forks, To: Bill Jensen, NDGFD, Bismark, RE: Cortisol Proposal, 10 pp.

Sayre, R. Oct.1, 1993. Pers. comm., R. Sayre, doctoral candidate, UND, with D. Sasse, USFS. USFS phone log, 1 p.

Schmutz, J. K. 1984. Ferruginous and Swainson's hawk abundance and distribution in relation to land use in southeastern Alberta. J. Wildl. Manage. 48(4): 1180-1187.

Schmutz, J. K., and D. J. Hungle. 1989. Populations of ferruginous and Swainsons' hawks increase in synchrony with ground squirrels. Can. J. Zool. 67: 2596-2601.

Schweitzer, D.F. July 20, 1989. A review of Category 2 Insects in USFWS Regions 3, 4, 5. Prepared by: Dale F. Schweitzer, The Nature Conservancy, 294 Washington St., Boston, MA 021108. Prepared for: USFWS, 1 Gateway Center, Newton Corners, MA. 143 pp.

Severson, K.E. 1976. Comments on shelterbelts, natural woodlands and wildlife in the northern Great Plains. *In* Trees and Land Use. Great Plains Agricultural Council Proceedings, Regina, Saskatchewan, Canada, July 12-15, 1976. p. 126-133.

Severson, K.E., and C.E. Boldt. 1978. Cattle, wildlife, and riparian habitats in the western Dakotas. *In* Management and Use of northern Plains rangeland. Reg. Rangeland Symp., Bismarck, N. Dakota, Feb. 27-28, 1978. p. 90-103.

Sharps, J.C. July 18, 1993. Little Missouri National Grasslands ferruginous hawk and raptor survey. Wildlife Systems, Box Elder, SD. USFS Contracted Survey, Custer N. F., 6 pp.

Shaw, T. and D. Kuehn. 1987. Preliminary Report of Mitigative Fieldwork Conducted at 32SL44, Slope County, North Dakota. Ms. on File, UNDAR-west, Belfield, ND.

Shelly, S. July 28, 1994. Revised list for Watch Plants in USFS Region 1. 4 pp.

Smith, H.B., December 19, 1968. USFS Memorandum: Reply to 5510 Modification, Subject: Cedar River National Grasslands, To: Regional Forester, R-1, 1 page.

Smith, T.S., J.T. Flinders, and D.S. Winn. 1991. A habitat evaluation procedure for Rocky Mountain bighorn sheep in the Intermountain West. Great Basin Naturalist 51(3): 205-225.

Solem, S. Sept. 21, 1993. Letter from Custer NF to Regional Forester on Draft Update - Northern Regional Sensitive Species List.

Solem, S. and Visconty, G. 1993. Southern Little Missouri EIS Oil and Gas Stipulations, USDA Forest Service, Billings, MT. Memorandum 11 pages.

Squires, J.R., S.H. Anderson, and R. Oakleaf. 1993. Home range size and habitat-use patterns of nesting prairie falcons near oil developments in northeastern Wyoming. J. Field Ornithol. 64(1): 1-10.

Stewart, R.E., Jr. (Ed.). 1973. Little Missouri Grasslands Study, southwestern North Dakota. Intermim Report No. 6, Conference on Resources of Southwestern North Dakota, Dickinson State College, July 10, 1973. 95 pp.

Story, Mark T. Oil and Gas Leasing EIS, Air Quality Analysis. Lewis and Clark National Forest.

Sullivan, M.G., J.A. Westfall, and L. Irby. 1989. Buglers of the badlands. North Dakota Outdoors. Nov 52(4): 15-17.

Sully, A. 1916. Letter to the Assistant Adjutant General, Department of the Northwest, July 17, August 13, 1864. South Dakota Historical Collections 8:310-311, 313-319.

Suter, G.W. II, and J.L. Jones. 1981. Criteria for golden eagle, ferruginous hawk, and prairie falcon nest site protection. Raptor Research 15(1): 12-18.

Swenson, J.E., S.J. Knapp, and H.J. Wentland. 1983. Winter distribution and habitat use by mule deer and white-tailed deer in southeastern Montana. Prairie Nat. Montana Dept. of Fish, Wildlife and Parks. 15: 97-112.

Thomas, D.B. March 25, 1993. Letter to: Douglas Backlund, Dept. Game, Fish & Parks, 523 East Capitol, Pierre, South Dakota 57501, From: Donald B. Thomas, Research Entomologist, USDA-ARS, USDS Sub-tropical Acgriculture Research Laboratory, 2301 S. International Blvd, Weslaco, Texas 78596, concerning Belfragi's chlorochroan bug (Chlorochroa belfragii) collected from Oakville Prairie and Burning Coal Vein Campground, ND. 3 pp.

Thomas, J.W., and C. Maser, J.E. Rodiek. 1979. Wildlife habitats in managed rangelands - the great basin of southeastern Oregon. General Technical Report PNW-80, USDA, USFS, 18 pp.

Thurman, M.D. 1988. The Little Missouri River: A Source of Confusion for Plains Ethnohistory. Plains Anthropologist. 33(122): 429-447.

Thwaites, R. 1904. The Original Journals of the Lewis and Clark Expedition. 8 Vols. Dodd, Mead, New York.

Unger, D.G. Nov. 5, 1993. National Hierarchical Framework of Ecological Units. Reply to: 1330/2060, To: Regional Foresters, Station Directors, Area Directors, IITF Director, and WO Staff. From: David G. Unger, Acting Chief. 19 pp.

USDA. Revised Sept. 1983. Principle Laws Relating to Forest Service Activities; IN: Agriculture Handbook No. 453. Manuscript on File.

USDA, SCS. 1986. Series Description, Brandenburg series, 1986.

USDA, SCS. 1987. Form 5's for the Baahish 1987, Brandenburg 1987, Cabba 1992, Cabbart 1992, Flasher 1991, Fleak 1974, Searing 1980, Wabek 1992, and Wayden 1991 series.

USDI, BLM/WO. 1991. Tim Bozorth, BLM Hyrologists report on hydrology for Southern Little Missouri & Cedar River NG EIS

USDI, BLM., NDSDH., USFS. November, 1990. North Dakota State Department of Health and Consolidated Laboratories, and USDA - FS. Williston Basin Regional Air Quality Study. pp. 1-253. Document on File.

USDI, BLM. July 9, 1990. Instruction memorandum No. MT-90-220 from the State Director to the State Management Team regarding Oil and Gas Leasing Stipulations. Northern Little Missouri EIS.

USDI, BLM. 1987. North Dakota Resource Management Plan and Environmental Impact Statement. Final, July 1987. USDI, BLM, Dickinson District, ND. 186 pp.

USDI, BLM. 1988. North Dakota Resource Management Plan and Environmental Impact Statement, Record of Decision.

USDI, BLM. 1982. Montana State Office. Draft Fort Union Regional Environmental Impact Statement. pp. 82-83.

USDI, NPS. Yearly. Annual Planning Information. Reports on File.

USDI, NPS. Bulletin 38:1.

EPA. 1986. Quality criteria for water 1986.

US EPA. Kirsher David S., Marcia E. Williams and Charles C. Masser. Projected Emission Factors for Highway Vehicles. Appendix D.

USFS. May 1994. Appendix 10 Air Quality Guidance. Region 1 Oil and Gas Leasing Desk Reference. pp. 161-175.

USFS. 1994. Data from the Medora Ranger District data base Spills. 1994.

USFS. March 1993. Lichens as bioindicaters of air quality. General Technical Report RM - 224. Rocky Mountain Forest and Range Experiment Station. 5 pp.

USFS. Feb. 19, 1993. Decision Notice, FONSI, and Environmental Assessment for the introduction of bighorn sheep into the Burnt Creek drainage area and Morman Butte Areas, McKenzie County, North Dakota, Responsible Official: Lesley W. Thompson, District Ranger, 31 pp.

USFS. March, 1992. Our approach to sustaining ecological systems. USDS, USFS, Northern Region, Missoula, MT. R-1 MSE _92_02. 15 pp.

USFS. Dec. 1992. Draft Environmental Impact Statement for management strategy for mountain plover. Pawnee National Grassland, Arapaho and Roosevelt National Forests, Weld County, Colorado.

USFS. April 2, 1991. Supplemental information report, Trail Creek Timber Sale, Wisdom Ranger District, Beaverhead National Forest, Beaverhead N. F., 48 pp.

USFS. June, 1991. North Dakota sensitive plant field guide: Custer National Forest, Little Missouri Grassland, Sheyenne National Grassland. USDA, USFS, Northern Region, Missoula, unnumbered pages.

USFS. September 1991. Final Environmental Impact Statement: Oil and Gas Leasing, Northern Little Missouri National Grassland. USDA, Custer National Forest, Billings, MT. Document on File.

USFS. 1988. Environmental Assessment of Proposed Development in the Randolph Field Area: McKenzie County, North Dakota. McKenzie Ranger District, Little Missouri National Grassland, Custer National Forest.

USFS., NDGS. August 1987. Custer National Forest and North Dakota Geological Survey, Memorandum of Agreement, with respect to Paleontological Resources.

USFS. June 1987. Custer National Forest and National Grasslands, Record of Decision. all pp. Document on File.

USFS. October 1986. Custer National Forest, Final Environmental Impact Statement, USDA, Forest Service, Billings, MT. 380 pp. and appendices, 343 pp. Document on File.

USFS. October 1986. Custer National Forest, Land and Resource Management Plan. USDA, Forest Service, Billings, MT. all pp. Document on File.

USFS. March 17, 1983. Environmental Assessment for Bighorn sheep transplant into the Lone Butte Essentially Roadless Area, McKenzie R. D., Custer N.F., R-1, Watford City, North Dakota, 9 pp.

USFS. 1980. Visual Character Types & Variety Class Description. USDA FS Northern Region. R1-80-11. 66 pp. Document on File.

USFS. 1979. Final Environmental Impact Statement, Roadless Area Review and Evaluation. FS-325 (RARE II). January. Document on File.

USFS. September 1974. Custer National Forest, Little Missouri National Grassland, Final Environmental Statement, Management Prescription for the Badlands Planning Unit pps. 4 & 20.

USFS. July 1974. Custer National Forest, Little Missouri National Grasslands, Badlands Planning Unit: Background Reports for Resources. 84 pp. Document on File.

USFS., USDI, BLM. April 1993. Final Environmental Impact Statement, Beartooth Mountains Oil and Gas Leasing EIS. Document on File.

USFS., USDI, BLM. Pike and San Isabel National Forests, Comanche and Cimarron National Grasslands Draft EIS. pp. IV 28 - IV 29.

USFWS. 1992. North Dakota's endangered, threatened and candidate species. U.S. Fish & Wildlife Service, Bismarck, ND. 30 pp.

USFWS. Sept. 1990. Report on the status of the swift fox, Vulpes velox, a category 2 taxon, in North Dakota. USFWS, Fish and Wildlife Enhancement, Bismarck, ND. 18 pp.

USFWS. 1984. American peregrine falcon recovery plan (Rocky Mountain/Southwest Population). Prepared in cooperation with the American Peregrine Falcon Recovery Team. USFWS, Denver, CO. 105 pp.

FWS/OBS. 1979.

Van Pelt, N.S., and D.W. Johnson. 1993. Isolated butte and mesa summits of the Colorado Plateau, pp. 93-96, In: Managing Pinon-Juniper ecosystems for sustainability and social needs. April 26-30, 1993. Sante Fe, New Mexico. USDA, USFS, Rocky Mountain Experiment Station, Fort Collins, Colorado. Gen. Tech. Rep. RM-236.

Verma, T.R. and J.L. Thames. 1978. Grading and shaping erosion control and vegetation establishment in dry regions. Reclamation of drastically disturbed lands. p. 403.

Wallace, G., P. Reed and J. McKean. October 1990. Department of Recreation Resources. Landscape Architecture, Colorado State University, Ft. Collins, Co. The Impact of External Development On The Economic And Aesthetic Values Of Theodore Roosevelt National Park. pg. 14, 26.

Wallestad, R., and D. Pyrah. 1974. Movement and nesting of sage grouse hens in central Montana. J. Wildl. Manage. 38(4): 630-633.

Wanek, A. December 3, 1990. North Dakota Water Commission. Personal communication for the Northern Little Missouri EIS.

Watkins, L. C. 1977. Euderma maculatum (spotted bat). Mammalian Species No. 77, The American Society of Mammalogists. pp. 1-4

Westmore, Clifford M. June 1983. Lichens and air quality in Theodore Roosevelt National Park. University of Minnesota, St. Paul Minnesota. pp. 27-28.

Wilcove, D.S. 1987. From fragmentation to extinction. Natural Areas Journal 7(1): 23-29.

Wilcox, L.V. 1955. Classification and Use of Irrigation Waters, U.S. Department of Agriculture Circular 969.

GLOSSARY AND LIST OF COMMON ACRONYMS

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

GLOSSARY OF TECHNICAL TERMS

A

Abandon To cease producing oil or gas from a well when it becomes unprofitable. A wildcat (exploration) well may be abandoned after it has been proven nonproductive. Usually, some of the casing is removed and salvaged, and one or more cement plugs placed in the borehole to prevent migration of fluids between formations and/or to the surface.

Abiotic a. The non-living material (as opposed to conceptual) components of the environment such as air, rocks, soil, water, coal, peat, plant litter, etc; b. Non-living components of an ecosystem; basic elements and compounds of the environment. [6]

Acquired Minerals Mineral rights that were patented into non-Federal ownership and were later re-acquired by the United States. Mineral rights under the Bankhead-Jones Farm Tenant Act of 1937 are an example of Acquired Minerals.

Active Lek Displaying grouse present during the spring breeding season at least one year within a period of five consecutive years. Leks are assumed to be active in the absence of five consecutive years of data collected according to scientific methods which shows the lek to be inactive. Scientific data collection assumes qualified observers, survey times and conditions appropriate to detect breeding activity, and subsequent written reports. Results of surveys and a list of active leks are part of the Custer Forest Plan Monitoring and Evaluation Report (Monitoring Item: C2 - sensitive species, C-9 - prairie grouse). Any lek for which five consecutive years of survey data is lacking is assumed to be active.

Active Nest An adult pair present at least one year within a period of five consecutive years. Nests are assumed to be active in the absence of five consecutive years of data collected according to scientific methods which shows the nest to be inactive. Scientific data collection assumes qualified observers, survey times and conditions appropriate to detect nesting activity, and subsequent written reports. The reporting process for results of surveys and a list of active nests are part of the Custer Forest Plan Monitoring and Evaluation Report (Monitoring Item: C2 - Sensitive Species, C8 - Special Interest). Evidence that a pair is present within a nesting territory can be based on evidence that eggs were laid or observations of 2 breeding-age birds that appear to be paired. In some species, the presence of a nest that has been recently built, repaired, or decorated may constitute evidence for occupancy because nest building behavior is probably elicited by the presence of a mate.

Administrative Facilities Those facilities, such as Ranger Stations, work centers and cabins, which are used by the Forest Service in the management of the National Forest.

Affected Environment The biological, social, economic, and physical environment that will or may be changed by proposed actions.

Air Quality Refers to air standards for various classes of air as designated by the Clean Air Act, P.L. 88-206: Jan. 1978.

Airshed Basic geographic units in which air quality is managed.

Alternative A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of several policies, plans, or projects proposed for decision making.

Alternative Energy Energy sources not from naturally occurring hydrocarbons such as crude oil or natural gas. This category may include nuclear, solar, and any other form of energy that would reduce dependence upon hydrocarbons.

Alluvial Pertaining to or composed of alluvium, or deposited by a stream or running water, e.g. gold or diamonds, associated with an alluvial placer.

Alluvial Plain A level or gently sloping tract or slightly undulating land surface produced by extensive deposition of alluvium, usually adjacent to a river that periodically overflows its bank.

Alluvium A general term for detrital deposits made by streams on river beds, flood plains, and alluvial fans; esp. a deposit of silt or silty clay laid down during time of flood. The term applies to stream deposits of recent time. It does not include subaqueous sediments of seas and lakes.

Amenity Values Resource use for which market values (or proxy values) are not or cannot be established. [1]

Ancillary Equipment, tools, buildings, and facilities needed to perform full development of fluid mineral resources. Depending upon level of development and stage these may be tank batteries, treaters, separators, flaring stacks, oil or water pipelines, tool sheds, pump units, etc.

Animal Unit Month The quantity of forage required by the equivalent of a 1,000 pound mature cow for one month. [1]

Application for Permit to Drill, (APD) Department of Interior application permit form to authorize oil and gas drilling activities on Federal land.

Aquatic Ecosystem A stream channel, lake or estuary bed, the water itself, and the biotic communities that occur therein.

Arterial Road Serves large land areas and usually connects with public highways and other arterial roads to and from an integrated network. Usually developed and operated for long term land and resource management purpose and constant service.

B

Background Viewing Area A landscape viewing area visible to a viewer from approximately three to five miles to infinity.

Best Management Practices (BMP) A practice or a combination of practices, that is determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practical means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals (40 CFR 130.2g).

Best Available Control Technology (BACT) The best available air pollution control technology for a given purpose as stipulated by the Environmental Protection Agency (EPA).

Big Game Those species of large mammals normally managed as a sport hunting resource.

Bighorn Sheep Escape Cover (a.k.a. escape terrain) Steep ($\geq$ 80-100%), rugged terrain, with a minimum of 10 meters of vertical rise, and limited visual obstruction, that is accessible to bighorn sheep for bedding, lambing, or escape from disturbance such as predators and humans. (Source: Sayre, R., September 21, 1994, p. 2)

Biodiversity Variety of life and its ecological process.

Biogeographic Area A continuous geographic area wherein species composition, both plant and animal, is more homogeneous than between adjacent areas.

Biological Evaluation (BE) A documented review of all Forest Service planned, funded, executed or permitted programs and activities for possible effects on endangered, threatened, proposed or sensitive species. A biological evaluation may be used or modified to satisfy consultation requirements for biological assessment of projects requiring an Environmental Impact Statement.

Biological Opinion An official report by the US Fish and Wildlife Service (FWS) issued in response to a formal Forest Service request for consultation or conference. It states whether an action is likely to result in jeopardy to a species or adverse modification to its critical habitat.

Biotic a. All the natural living organisms in a planning area and their life processes; b. Refers to living components of an ecosystem, e.g., plants and animals; c. Of non-living organisms in their ecological rather than their physiological relations; d. Pertaining to any aspect of life, especially to characteristics of entire populations or ecosystems. [6]

Blowout An uncontrolled expulsion of gas, oil, or other fluids from a drilling well. A blowout or "gusher", occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid and when blowout prevention equipment is absent or fails.

Blowout Preventer (BOP) A stack or an assembly of heavy-duty valves attached to the top of the casing during drilling to control well pressure and prevent fluid or gas loss in the event of excess pressure buildup and a potential blowout. The assembly includes a remote mechanism to actuate closing by hydraulic or mechanical means.

Borrow Pits An excavated area where earth material (sand, gravel, etc.), taken from one location to be used for fill at another location, has been obtained.

Brackish Water Water that contains relatively moderate concentrations of any soluble salts. Brackish water is saltier than fresh water but not as salty as salt water or brine water.

Brine Water containing relatively large concentrations of dissolved salts, particularly sodium chloride. Brine has higher salt concentrations than ordinary ocean water.

Brine Pit An excavated pit used to hold brine produced from a well.

Buffer Zone a) An area between two different land uses that is intended to resist, absorb, or otherwise preclude developments or intrusions between the two use areas; or, b) A strip of undisturbed vegetation that retards the flow of runoff water, causing deposition of transported sediment and reducing sedimentation in the receiving stream.

Bureau of Land Management (BLM) The Department of Interior agency responsible for managing most Federal government subsurface minerals. BLM also has surface management responsibility for Federal lands assigned to it.

C

Candidate Species A species being considered for listing as a federally endangered or threatened species.[6]

Canyonlands Associated with perennial, intermittent, and ephemeral streams located in the eroded and incised drainages found primarily within a corridor along the Little Missouri River within the Little Missouri National Grasslands, Canyonlands are defined quantitatively according to the following criteria:

Length: The minimum length of a canyonland is 1,320 feet as measured on a USGS quadrangle map (1:24,000 or 2.64 in/mile scale) from the mouth of the stream to the upper head waters.

Width: The width, usually measured at the mouth of the stream course, must be 2,000 feet or less with a height of at least 100 feet on both sides of the canyonland.

Flat Stream Bottoms: Canyonlands must contain a relatively flat bottom with at least a 40 foot change in elevation as measured within a 1,000 foot wide corridor at the bottom of the canyon and perpendicular to the stream.

Width and Height Requirement: The width and height requirement was considered met when it included more than 20% of the total length of the canyon. For example, if the total length of the canyon is 3,000 feet and the height is 100 feet for 500 feet (17%) and 60 feet for the remaining 2,500 feet (83%) the canyon was not delineated.

Vegetation: Canyonlands must contain trees or shrub type vegetation which occupy at least 5% of the stream drainage. Northerly slopes associated with canyonlands retain relatively more moisture and are capable of supporting trees and shrubs forming greater vertical structure diversity of vegetation than the relatively flat surrounding rolling prairie topography. Juniper stem density and basal area values were highest on northwest facing slopes (Jensen 1988, p. 169-177). Green ash stands usually occurred on gradual slopes with a northeastern orientation (Jensen 1988, p. 177). Percent species composition of total graminoids in the brush complex vegetation types sampled was highest on south to southwest slopes (Jensen 1988, p. 190). Percent species composition of total shrubs in the brush complex vegetation types sampled was also highest on slopes with a northerly aspect and in arroyos (Jensen 1988, p. 192).

Polygons: Each canyonland polygon was identified independently of canyonlands located in adjacent drainages to permit analysis by sub-drainage. In cases where two canyonland polygons shared the same adjacent boundary the information was digitized from each side of the line to provide separate polygons in GIS.

Casing Steel pipe placed in an oil or gas well to prevent the hole from collapsing.

Cell See pixel.

Christmas Tree The control valve, pressure gauges, and chokes assembled at the top of a well to control the flow of oil and gas after the well has been completed.

Class II Injection Well A well, as defined by the U.S. Environmental Protection Agency, that injects fluids: a. that have been brought to the surface in connection with oil or natural gas production (produced waters); b. for enhancing recovery of oil or natural gas; or c. for storing liquid hydrocarbons.

Closure The administrative order that does not allow specified users in designated areas or on Forest development roads or trails.

Closed Mud System A drill mud system that reuses or reclaims all the drilling fluid used. Oil-base mud systems are often closed mud systems.

Code of Federal Regulation (CFR) Regulations developed at the Department level for the specific implementation of a Public Law. For example, 36 CFR 228 are the implementing regulations for the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA).

Collector Road Serves smaller land areas than an arterial road and is usually connected to a Forest arterial of public highway, may be operated for constant or intermittent service depending on land use and resource management objective.

Commodities Resources with commercial value; all resource products which are articles of commerce, such as timber, range forage and minerals. [1]

Completion The activities and methods to prepare a well for production. Includes installation of oil or gas well production equipment.

Conditions of Approval (COA) Mitigation measures applied at the time a Plan of Operation for the Application for Permit to Drill is approved. These are site specific and may not modify the original intent of the lease or interfere with the rights granted in it.

Congressionally Designated Areas Areas established by Congressional legislation, such as National Wildernesses, National Wild and Scenic Rivers, and National Recreation Areas.

Connected Action A connected action is one type of action considered in determining the scope of the Proposed Action. Connected actions are actions that closely relate and therefore should be discussed in the same EIS (40 CFR 1508.29(i)(ii)(iii). Actions are connected if:
(i) Automatically trigger other actions which may require environmental impact statements.
(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.
(iii) Are interdependent parts of larger actions and depend on the larger action for their justification.

Connectivity Condition in which the spatial arrangement of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation. [9]

Controlled Surface Use (CSU) Stipulation The Controlled Surface Use (CSU) stipulation is intended to be used when fluid mineral occupancy and use are allowed on all or portions of the lease area year-round, but because of special resource concerns or values, lease activities must be strictly controlled. It will be used in areas where restrictions or controls are necessary for specific types of activities rather than all activities, and applies to development as well as production phases. It may be used to route on-lease access roads and move pads and facilities further than 200 meters to protect a resource that is too small or extremely difficult to map, such as heads of canyonlands.

Core Ranges (Big game) Those portions of home ranges of animals that receive disproportionately high seasonal use and therefore are deemed key habitat for the herd.

Corridor An area through which species can move from one place to another over time in response to changes in environment or as natural parts of their history. [4]

Corridor (Utility Corridor) A linear strip of land which has ecological, technical, economic, social, or similar advantages over other areas for the present or future location of transportation or utility routes.

Cost The negative or adverse effects of expenditures resulting from an action. Costs may be monetary, social, physical, or environmental in nature.

Council On Environmental Quality (CEQ) An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

County Road A road under the jurisdiction of the county.

Cover Vegetation used by wildlife for protection from predators, or to ameliorate conditions of weather, or in which to reproduce.

Critical Habitat Specific areas within the geographical area occupied by threatened, endangered or sensitive species on which are found those physical and biological features (1) essential to the conservation of the species and (2) which may require special management considerations or protection. Critical habitat shall not include the entire geographic area which can be occupied by the threatened and endangered species.

Crown The part of a tree or woody plant bearing live branches and foliage. [12]

Crown Class A class of tree based on crown position relative to the crowns of adjacent trees.
Dominant - Trees with crowns extending above the general level of the main canopy of even-aged groups of trees, and receiving full light from above and partly from the sides.
Codominant - Trees with crowns forming the general level of the main canopy in even-aged groups of trees, receiving full light from above and comparatively little from the sides.
Intermediate - Trees with crowns extending into the lower portion f of the main canopy of even-aged groups of trees, but shorter in height than the codominants. They receive little direct light from above and none from the sides.
Overtopped (Suppressed) - Trees of varying levels of vigor that have their crowns completely covered by the crowns of one or more neighboring trees. [12]

Cultural Resources The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation.

Cumulative Effect The impact on the environment which results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Cumulative Effects Analysis An Analysis of the effects of the environment which results from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal), or person undertakes such other actions. [7]

D

Deepen To increase the depth of a well. Deepening is generally a workover operation carried out to produce from a deeper formation or to control excessive gas found in the upper levels of a reservoir.

Developed Recreation Recreation that occurs where improvements have been added to enhance recreation opportunities and accommodate intensive recreation activities in a defined area.

Developed Recreation Sites Relatively small, distinctly defined areas where facilities such as hardened trailer and tent pads, roads, drinking water, toilets, parking areas, picnic tables and fireplaces are provided for concentrated public uses, (i.e. campgrounds, picnic and swimming areas).

Development Well A well drilled in proven territory (usually within 1 mile of an existing well).

Directional Drilling The intentional deviation of wellbore from vertical to reach subsurface areas not directly under the drilling site.

Direct Effects Effects on the environment which occur at the same time and place as the initial cause or action.

Dispersed Recreation That portion of outdoor recreation use which occurs outside of developed sites in the unroaded and roaded Forest environment, (i.e. hunting, backpacking and berry picking).

Displacement As applied to wildlife, forced shifts in the patterns of wildlife use, either in location or timing of use.

Disposal Well A well into which produced water from other wells is injected into an underground formation for disposal.

District Ranger The official responsible for administering the National Forest System lands on a Ranger District.

Diversity The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Diversity - (Alpha, Beta, Gamma) Reed Noss (1983) discusses three scales of diversity; alpha, beta, and gamma. Alpha diversity deals the number of species within a single habitat or community. Beta diversity addresses the change of species along a series of habitats. Gamma diversity is the species diversity of a large geographic region.

Divisions Subdivisions of a Domain determined by isolating areas of definite vegetational affinities (prairie or forest) that fall within the same regional climate. Divisions are delineated according to: (a) the amount of water deficit (which subdivides the Dry Domain into semi-arid, steppe, or arid desert, and (b) the winter temperatures, which have an important influence on biological and physical processes and the duration of any snow cover. This temperature factor is the basis of distinction between temperate and tropical/subtropical dry regions. Divisions are named for the main climatic regions they delineate, such as Steppe, Savannah, Desert, Mediterranean, Marine, and Tundra. [8]

Domains Subcontinental divisions of broad climatic similarity, such as lands that have dry climates, which are affected by latitude and global atmospheric conditions. For example, climate of the Polar Domain is controlled by arctic air masses, which create cold, dry environments where summers are short. In contrast, the climate of the Humid Tropical Domain is influenced by equatorial air masses and there is no winter season. Domains are also characterized by broad differences in annual precipitation, evapotranspiration, potential natural communities, and biologically significant drainage systems. The four Domains are named according to the principal climatic descriptive features: Polar, Dry, Humid Temperate, and Humid Tropical. [8]

Draft Environmental Impact Statement (DEIS) A detailed written statement as required by Sec. 102 (2)(C) of the National Environmental Policy Act (NEPA).

Drainage The uncompensated loss of hydrocarbons from Federal lands from wells on adjacent nonjurisdictional lands or jurisdictional lands with lower participation, allocation, royalty rate or distribution of funds, resulting in revenue losses to the Federal lessor.

Drill Pipe The heavy seamless tubing used to rotate the drill bit and circulate the drilling fluid. The standard drill pipe section is 30 feet long (a joint).

Drill Rig The mast, drawworks, and attendant surface equipment of a drilling or workover unit.

Dry Hole Any well incapable of producing oil or gas in commercial quantities. A dry hole may produce water, gas or even oil, but not enough to justify production.

E

Ecodata A set of structured data base files used for storage of field data collected using ECODATA sampling methods.

Ecogroup Ecosystems grouped on the basis of capabilities for the type of land uses that occur.

Ecological Approach Natural resource planning and management activities that assure consideration of the relationship between all organisms (including humans) and their environment.

The approach to natural resource management that follows the principles as described in the paper, "An Ecological Approach to Management - A framework for National Guidance".[6]

Ecological Unit A mapped landscape unit designed to meet management objectives, comprised of one or more ecological types. [7]

Ecological Province A continuous geographic area in which the ecological systems, produced by climate, topography, biota and soil can be described as meaningfully different than other areas.

Ecoregion Scale (Ecological Unit) At the Ecoregion scale, ecological units are recognized by differences in global, continental, and regional climatic regimes and gross physiography. The basic assumption is that climate governs energy and moisture gradients, thereby acting as the primary control over more localized ecosystems. Three levels of Ecoregions, adapted from Bailey, are identified in the hierarchy: Domains, Divisions, and Provinces. (See each of these for further information). [8]

Ecosystem A complete, interacting system of organisms considered together with their environment, for example; marsh, watershed or lake.

Ecosystem Composition The specific elements that make up an interacting system, i.e., plant and animal species, microorganisms, soil type, landform, and climate regimes. [7]

Ecosystem Functions (Processes): The major processes of ecosystems that regulate or influence the structure, composition, and pattern. These include nutrient cycles, energy flows, trophic levels (food chains), diversity patterns in time/space development and evolution, cybernetics (control), hydrological cycles and weathering processes. [7]

Ecosystem Management An approach to land management that places the productivity of resource uses or values in the context of desired conditions for the ecological system.

Ecosystem Structure The physical arrangement of the various components. Also, trophic structure; measured in standing crop or energy fixed per unit area per unit time. May be pyramids of numbers, biomass, or energy flows. [7]

Effects Physical, biological, social and economic results (expected or experienced) resulting from achievement of outputs. Effects can be direct, indirect and cumulative and may be either beneficial or detrimental. (See Impacts)

Elevated Flares The use of piping and a burn stack to elevate the flare that burns unusable petroleum vapors. Elevated flares may include an ignitor to ensure continuous burning or an incinerator where gas is added to ensure complete combustion of petroleum products.

Endemic Restricted to a specified region or locality. [7]

Endangered Plants See Threatened and Endangered Species.

Endangered Species See Threatened and Endangered Species.

Enhanced Recovery The use of artificial means to increase reservoir pressures or reduce fluid resistance to increase the amount of hydrocarbons that can be recovered from a reservoir. A reservoir depleted by normal extraction practices usually can be restored by secondary or tertiary methods of enhanced recovery.

Environmental Analysis (EA) An analysis of alternatives actions and their predictable short and long term environmental effects which include physical, biological, economic, social and environmental design factors and their interactions. Completion of this level of analysis may result in a Decision Notice (DN) and Finding of No Significant Impact (FONSI).

Ephemeral Stream A stream that flows only in direct response to precipitation and whose channel is at all times above the water table. [5]

Erosion The group of processes whereby earthy or rocky material is worn away by natural sources such as wind, water or ice and removed from any part of the earth's surface and redeposited elsewhere.

Even-Aged Stand A stand of trees containing a single age class in which the range of tree ages is usually less than 20 percent of rotation. [12]

Exotic Species Species which occur in a given place, area, or region as the result of direct or indirect, deliberate or accidental introduction of the species by humans, and for which introduction has permitted the species to cross a natural barrier to dispersal. [6]

Exploration Well A well drilled in an area where there is no oil or gas production. Same as a "wildcat" well.

Extinct No longer existing. [6]

F

Final Environmental Impact Statement (FEIS) The final version of the public document required by NEPA.

Flare The piping and burners used to dispose (by burning) of unusable vapors from a well or collection plant. The flaring of oil field gas is regulated by North Dakota State Department of Health ND Air Pollution Control Rules, including applicable AAQS and PSD requirements.

Forage All browse and nonwoody plants available to livestock or wildlife for feed.

Foreground Viewing Area The landscape area visible to an observer from the immediate area to ½ mile.

Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) The parent act that preceded Forest Planning. This act directed that the National Forest System begin systematic resource planning on the National Forest units.

Forest Development Roads (FDR) A Forest road under jurisdiction of the Forest Service.

Forest Development Transportation System Those facilities, Forest Development Roads, trails, and airfields, in the transportation network and under Forest Service jurisdiction.

Forest Plan A comprehensive management plan prepared under the National Forest Management Act of 1976 that provides standards and guidelines for management activities on the Custer National Forest. The Custer Forest Plan was approved June 1987.

Forest Service (FS) The agency of the United States Department of Agriculture responsible for managing National Forests and Grasslands.

Fracture Treatment A method of stimulating well production by increasing the permeability of the producing formation. Under extremely high hydraulic pressure, the fracturing fluid (water, oil, dilute hydrochloric acid, or other fluids) is pumped into the formation and parts or fractures it. Proppants or propping agents such as sand or glass beads are pumped into the formation as part of the fracturing job. The proppants become wedged in the opened fractures, leaving channels for oil to flow into the well after the hydraulic fracture pressure is released. This process is often called a "frac job". When high concentrations of acid are used, it may be called an "acid-frac job".

Fragile Soils Soils that are located on steep topography, are highly susceptible to wind/or water erosion, have high potential for mass failure, are shallow to bedrock, are saline or alkaline, or soils which are virtually impossible or extremely difficult to reclaim.

Fragmentation Breaking up of contiguous areas into progressively smaller patches of increasing degrees of isolation. [6] Opposite of connectivity.

G

Game Species Any species of wildlife or fish for which seasons and bag limits have been prescribed under State or Federal Laws, Codes and Regulations, and which are normally harvested by hunting, trapping, and fishing.

Geology The study of the planet Earth. It is concerned with the origin of the planet,the material and morphology of the Earth, and its history and the processes that acted (and act) upon it to affect its historic and present forms.

Guilds A group of organisms that share a common food resource. [6]

H

Habitat A place where a plant or animal naturally or normally lives and grows.

Habitat Indicator Species Species whose population changes are believed to indicate effects of management on other species of a major biological community or on water quality. The forest will provide for the maintenance and improvement of habitats for these indicator species. [1] (p. 18)

Habitat Type An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Habitat Type Group A logical grouping of habitat types to facilitate resource planning and public presentations.

Healthy Ecosystem An ecosystem in which structure and function allow the maintenance of biological diversity, biotic integrity, and ecological processes over time. [6]

Hiding Cover Trees or other vegetation of sufficient size and density to conceal animals from view at 300 feet.

High Seral The last seral stage before a vegetation community becomes climax.

Heterogeneity The quality or state of being heterogeneous.

Heterogeneous Consisting of dissimilar ingredients or constituents.

Human Dimension An integral component of Ecosystems Management that recognizes people are part of ecosystems, that people's pursuits of past, present, and future desires, needs and values (including perceptions, beliefs, attitudes and behaviors) have and will continue to influence ecosystems and that ecosystem management must include consideration of the physical, emotional, mental, spiritual, social, cultural, and economic well being of people and communities. [7]

Human Environment The factors that include, but are not limited to biological, physical, social, economic, cultural and aesthetic factors that interrelate to form the environment.

I

Impacts Physical, biological, social and economic results (expected or experienced) resulting from achievement of outputs. Effects can be direct, indirect and cumulative and may be either beneficial or detrimental. (See Effects)

Indicator Species In the Forest Plan, a species of animal or plant whose presence is a fairly certain indication of a particular set of environmental conditions. Indicator species serve to show the effects of development actions on the environment.

Indigenous Species A species which originally inhabitated a particular National Forest or National Grassland (see definition of exotic). [3]

Indirect Effects Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Injection Well A well used to inject fluids into an underground formation to increase reservoir pressure.

Interior Habitat That portion of an ecosystem or a fragment that is far enough removed from its outside boundaries so as not to be significantly influenced by edge effects. The width of the zone effected by the edge, and accordingly, the core of the interior habitat, will vary with the composition and structure of the ecosystem and the requirements of the species being considered. Species that require specific attributes of interior habitats are often referred to as interior species. [11]

Intermittent Stream A stream that flows only a certain times of the year when it receives water from springs or from some surface source such as melting snow. [5]

Interdisciplinary Team (ID Team) A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view to bear on the problem.

Inventoried Roadless Area (IRA) An area identified as possessing the characteristics of Natural Integrity, Apparent Naturalness, Remoteness, Solitude, and other special features. These areas were originally identified in the Roadless Area Review and Evaluation (RARE), 1973.

K

Keystone Species A species that plays a pivotal role in an ecosystem and upon which the diversity of a large part of the community depends. Keystone species are often the dominant species at their tropic level, but their importance in a biotic community is greater than abundance alone might suggest. Examples include beaver-wetland and pocket gopher-meadow. (p. 233 [10])

Key Wildlife Area Any area which is critical to wildlife during at least a portion of the year. This importance may be due to vegetative characteristics such as residual nesting cover, or behavioral aspects of the animals such as lambing areas. Key areas include: winter ranges, lambing/fawning/calving areas, dancing/strutting grounds, nesting areas, breeding grounds, elk wallows, riparian and woody draws, and roosting areas.

L

Land Exchange The conveyance of non-Federal land or interest to the the United States in exchange for National Forest System land or interests in land.

Landscape An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota and human influences throughout the area. Landscapes are generally of a size, shape and pattern which is determined by interacting ecosystems. [6]

Landscape Scale (Ecological Unit) At the Landscape scale, ecological units are defined by general topography, geomorphic process, surficial geology, soil and potential natural community patterns and local climate. These factors affect biotic distributions, hydrologic function, natural disturbance regimes and general land use. Local landform patterns become apparent at this level in the hierarchy, and differences among units are usually obvious to on-the-ground observers. At this level, terrestrial features and processes may also have a strong influence on ecological characteristics of aquatic habitats. Landtype Association ecological units represent this scale in the hierarchy. [8]

Landtype An inventory map unit with relatively uniform potential for a defined set of land uses. Properties of soils, landform, natural vegetation and bedrock are commonly components of landtype delineation used to evaluate potentials and limitations for land use. [1]

Landtypes Subdivisions of Landtype Associations or groupings of Landtype Phases based on similarities in soils, landform, rock type, geomorphic process and plant associations. Land surface form that influences hydrologic function (e.g., drainage density, dissection relief) is often used to delineate different landtypes in mountainous terrain. Valley bottom characteristics (e.g., confinement) are commonly used in establishing riparian landtype map units. Names of Landtypes are to include an abiotic and biotic component. [8]

Landtype Associations Groupings of Landtypes or subdivisions of Subsections based upon similarities in geomorphic process, geologic rock types, soil complexes, stream types, lakes, wetlands, and series, subseries, or plant association vegetation communities. Repeatable patterns of soil complexes and plant communities are useful in delineating map units at this level. Names of Landtype Associations are often derived from geomorphic history and vegetation community. [8]

Landtype Phase More narrowly defined Landtypes based on topographic criteria (e.g., slope-shape, steepness, aspect, position, hydrologic characteristics, associations and consociations of soil taxa, and plant associations and phases. These factors influence or reflect the microclimate and productivity of a site. Landtype phases are often established based on interrelationships between soil characteristics and potential natural communities. In riparian mapping, landtype phases may be established to delineate different stream type environments. Naming is similar to Landtypes. [8]

Land Unit Scale (Ecological Unit) At the basic Land Unit scale, ecological units are designed and mapped in the field based on properties of local topography, rock types, soils, and vegetation. These factors influence the structure and composition of plant communities, hydrologic function, and basic land capability. Landtypes and Landtype Phases are the ecological units mapped at this scale. [8]

Lease a) A legal document that conveys to an operator the right to drill for oil and gas; or, b) The tract of land, on which a lease has been obtained, where wells and production equipment may be located.

Lease Notice An attachment to a lease to transmit information to the lessee at the time of lease issuance for submitting acceptable plans of operation, or to assist in administration of leases. The Lease Notice does not involve new restrictions or requirement, but it informs the lessee of any requirements in a law, regulation, standard lease term, or onshore oil and gas orders. (compare **Stipulation**)

Leasing Reform Act of 1987 The Federal Onshore Oil and Gas Leasing Reform Act of 1987. (FOOGLRA). Implementing regulations are found in 36 CFR 228.

Lek See active lek.

Linkages Characteristics of a landscape that provides direct physical connections between two or more places. [4]

Linkages Route that permits movement of individual plant (by dispersal) and animals from a Landscape Unit and/or habitat type to another similar Landscape Unit and/or habitat type. [6]

Local Roads Connect terminal facilities with collector or arterial roads or public highways. Location and standards are usually controlled by specific resource activity and the road may be for long or short term service.

Long-term Effects Those effects which generally occur after the maxium 15-year life of the Forest Plan.

Low Seral The earliest stage of plant succession; the stage where pioneer plants inhabit a community.

M

Macroscale Includes ecological units of domain, division, province, and subsection. (Compare mesoscale and microscale.)

Management Area An aggregation of capability areas which have common management direction under the Forest Plan and may be noncontiguous in the Forest. Consists of a grouping of capability areas selected through evaluation procedures and used to locate decisions and resolve issues and concerns.

Management Direction A statement of multiple-use and other goals and objectives, the associated management practices identified by the Forest Service in the planning process.

Management Indicator Species Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish including those that are socially or economically important.

Memorandum of Understanding A written plan between the Forest Service and other non-Federal parties for carrying out their separate activities in a coordinated and mutually beneficial manner.

Mesoscale Includes ecological units of sub-section and landtype association. (Compare macroscale and microscale.)

Microscale Includes ecological units of landtype phase and site. (Compare macroscale and mesoscale.)

Microsite A rock outcrop, snag, seep, stream pool and other environmental features unique in character but generally too small to map.

Mid Seral The middle stage of plant succession.

Middleground Viewing Area The landscape area visible to a viewer from ½ mile to about three to five miles.

Mineral Rights Mineral rights outstanding are third party rights, an interest in minerals not owned by the person or party conveying the land to the United States. It is an exception in the deed which is the result of a prior conveyance separating title of certain minerals from the surface estate.
Reserved mineral rights are the retention of ownership of all or part of the mineral rights by a person or party conveying land to the United States. Conditions for the exercising of these rights have been defined in the Secretary's "Rules and Regulations to Govern Exercising of Mineral Rights Reserved in Conveyance to the United States" attached to and made a part of a deed reserving mineral rights.

Mitigate Under the NEPA, mitigation applies to adverse environmental impacts.

Mitigation Avoiding or minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact by preservation and maintenance operations during the life of the action; and compensating for the impact by replacing or providing substitute resources or environments.

Monitoring To watch, observe, or check, especially for a specific purpose, such as to keep track of, regulate, or control (Webster's dictionary). [6]

Monitoring and Evaluation The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been met and how closely management standards have been applied.

Mule Deer Habitat See Canyonlands.

Multiple Use (MU) The management of all the various renewable surface resources of the National Forest System so that they are utilized in the combination that will best meet the needs of the American people by making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions and recognizing that some lands will be used for less than all of the resources. It also provides for harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

N

National Environmental Policy Act of 1969 (NEPA) An act which encourages productive and enjoyable harmony between man and his environments; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality.

National Forest Management Act A law passed in 11976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest plans and preparation of regulations to guide that development. [1]

National Forest System Includes all National Forest System lands reserved or withdrawn from the public domain of the United States; all National Forest System lands acquired through purchase, exchange, donation, or other means; the national grasslands; and land utilization projects administered by the Forest Service under Title III of the Bankhead-Jones Farm Tenant Act of 1937.

National Wild and Scenic River System Rivers with outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values designated by Congress and the Wild and Scenic Rivers Act of 1968 for preservation of their free-flowing condition.

Natural Variability Relation between frequency and natural disturbance, e.g., fire, wind, and other small to more common large disturbances and the effect on individual plants and animals, communities and ecological systems.

Native Species All animal and plant species originally occurring in the United States. [3]

New Road Construction Investment in construction of a road to provide access which adds new miles of road to the transportation system.

Neotropical migrant Migratory birds that have their winter habitat in southern latitudes (tropics) and their summer or breeding habitat in northern latitudes.

No Action Alternative The management direction, activities, outputs, and effects that are likely to exist in the future if the current trends and management would continue unchanged. Under NEPA it means following the current approved Forest Plan management direction and guidance.

Nongame Species of animals which are not managed as a sport hunting resource.

Nonpoint Source Pollution Sources, including natural pollution sources not directly or indirectly caused by man, from which the pollutants discharged are: a. Induced by natural processes, including precipitation, seepage, percolation, and runoff; b. Not traceable to any discrete or identifiable facility; or c. Better controlled through the utilization of Best Management Practices, including process and planning techniques.

No Surface Occupancy (NSO) Stipulation The NSO stipulation is intended for use only when other stipulations are determined insufficient to adequately protect the other resource values. An NSO stipulation is not needed if the desired protection could be accomplished by relocating proposed operations 200 meters or less as allowed under the Standard Lease Terms (43 CFR 3101.1-2 Surface use rights). The Forest Plan direction for the use of the NSO lease stipulation does not apply to road construction. However, the understanding is that this interpretation may be reviewed for appropriateness on a case by case basis, resulting in Forest Plan amendments if necessary. New construction or maintenance of existing roads will be permitted within most management areas, whether the NSO stipulation applies management area wide or not.

Noxious Weed According to the Federal Noxious Weed Act (PL 93-629), a weed that causes disease or has other adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health. [5]

O

Objective A concise time-specific statement of measurable planned results that respond to preestablished goals. An objective from the basis for further planning, to defining the precise steps to be taken and the resources to be used in achieving identified goals.

Off Highway Vehicle Any motorized vehicle designed for and/or capable of travel off roads.

P

Paleontology The study of life in past geologic periods, based on fossil plants and animals and including phylogeny, their relationships to existing plants and animals, and the chronology of the Earth's history.

Particulates Small particles suspended in the air and generally considered pollutants.

Perennial Stream A stream that flows continuously year round. [5]

Pit Flaring The burning of unusable petroleum vapors in an excavated pit.

Pixel A picture element, one of the tiny dots that make up a character or graphic.

Plot Data Point or plot sampling units are used to gather ecological data for inventory, monitoring, quality control and for developing classifications of vegetation, soils or ecological types. This plot data feeds into data bases for analysis, description, and interpretation of ecological units. The plots can serve as reference sites for ecological types. Plots, while not mappable, can be shown on maps as point data. [8]

Polygon A closed plane figure bounded by straight lines, a unit of measurement used in Geographic Information Systems.

Policy A guiding principle upon which is based a specific decision or set of decisions.

Population A group of individuals with common ancestry that are much more likely to mate with one another than with individuals from another such group. [6]

Prehistoric Site Archeologic sites associated with American Indians and usually occurring before contact with Europeans.

Prescribed Burning The scientific, intentional burning of wildland fuels in either their natural or modified states under conditions to allow the fire to continue to a predetermined area and to produce the intensity of heat and rate of spread needed to meet certain objectives. [5]

Prevention of Significant Deterioration of Air Quality (PSD) A classification established to preserve, protect, and enhance the air quality in National Wilderness Preservation System areas in existence prior to August 1977 and other areas of National significance, while ensuring economic growth can occur in a manner consistent with the preservation of existing clean air resources. Specific emission limitations and other measures, by class, are detailed in the Clean Air Act (42 U.S.C. 1875 et 15q).

Primitive Recreation Setting A classification of the recreation opportunity spectrum (ROS) that characterizes an essentially unmodified natural environment of a size or remoteness that provide significant opportunity for isolation from the signs and sounds of man and a feeling of vastness of scale. Visitors have opportunity to be part of the natural environment, encounter a high degree of challenge and use a maximum of outdoor skills but have minimum opportunity for social interaction.

Primitive Roads Roads that were developed through use but were not constructed. These roads are not maintained for passenger cars and are excluded from the Highway Safety Act.

Productive The ability of an area to provide goods and services and to sustain ecological values. [6]

Project Area Area of analysis for proposed leasing on the Grand River and Medora Ranger Districts of Custer National Forest.

Proposed Action In terms of National Environmental Policy Act, the project, activity, or action that a Federal agency intends to implement or undertake and which is the subject of an environmental analysis.

Province Subdivisions of a Division that correspond to broad vegetation regions, which conform to climatic subzones controlled primarily by continental weather patterns such as length of dry season and duration of cold temperatures. Provinces are also characterized by similar soil orders. The climatic subzones are evident as extensive areas of similar potential natural communities. Provinces are named typically using a binomial system consisting of a geographic location and vegetative type such as Bering Tundra, California Dry-Steppe and Eastern Broadleaf Forests.

Highland areas that exhibit altitudinal vegetational zonation and that have the climatic regime (seasonality of energy and moisture) of adjacent lowlands are classified as Provinces. The climatic regime of the surrounding lowlands can be used to infer the climate of the highlands. For example, in the Mediterranean Division along the Pacific Coast, the seasonal pattern of precipitation is the same for the lowlands and highlands except that the mountains receive about twice the quantity. These provinces are named for the lower elevation and upper elevation (subnival) belts, e.g., Rocky Mountain Forest-Alpine Meadows. [8]

Public Domain Minerals Mineral rights that have always been the property of the United States.

Public Roads Any road under the jurisdiction of and maintained by a public authority and "open to public travel". (Includes motor bike, trail bike, snowmobile, 4 wheel drive, high clearance vehicles).

R

Raptor Birds of prey, such as owls, hawks, and eagles. [5]

Reclamation Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation and other work such as fertilization and fencing necessary to restore it for use.

Record of Decision (ROD) A document separate from but associated with an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action.

Recreation Opportunities The combination of recreation settings, activities and experiences provided by an area.

Recreation Opportunity Spectrum **(ROS)** A system for planning and managing recreation resources that recognizes recreation activity opportunities, recreation settings, and recreation experiences along a spectrum or continuum of settings as follows:

- **Primitive** - Characterized by essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use is not permitted.
- **Semi-Primitive Non-Motorized** - Characterized by predominately natural or natural appearing environment of a moderate to large size. Concentrations of users is low, but there is often evidence of other area users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is not permitted.
- **Semi-Primitive Motorized** - Characterized by a predominantly natural or natural-appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.
- **Roaded Natural** - Characterized by predominantly natural appearing environment with moderate evidence of the the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with the evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Motorized use is permitted.
- **Rural** - Characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites.
- **Urban** - Characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Vegetative cover is often exotic and manicured. Sights and sounds of humans on-site are predominant.

Recreation Visitor Days (RVD) One visitor day equals 12 hours of human use (one person for 12 hours, or 12 people for 1 hour, or any combination thereof).

Research Natural Area A physical or biological unit in which current natural conditions are maintained insofar as possible. In such areas, activities such as grazing and vegetation manipulation are prohibited unless they replace natural processes and contribute to the protection and preservation of an area. Such recreation activities as camping and gathering plants are discouraged. [5]

(RPA) Forest and Rangeland Renewable Resources Planning Act of 1974 The parent act that proceeded Forest Planning. This act directed that the National Forest System begin systematic resource planning on the National Forest units.

Reserve Pit a) An excavated pit that may be lined with plastic, that holds drill cuttings and waste mud; or, b) A standby pit which holds already-mixed drilling mud for use in an emergency.

Revegetation The reestablishment and development of self sustaining plant cover. On disturbed sites, this normally requires human assistance such as seed bed preparation, reseeding and mulching.

Rig The mast, drawworks, and attendant surface equipment of a drilling or workover unit.

Riparian Areas Geographically delineable areas with distinctive resource values and characteristics that comprise the riparian ecosystems.

Riparian Ecosystem a) Ecosystems transitional between terrestrial and aquatic ecosystems. Also streams, lakes, wet areas and adjacent vegetation communities and their associated soils which have free water at or near the surface. b) Those assemblages of plants, animals, and aquatic communities whose presence can either be directly or indirectly attributed to factors that are water influenced or related. Interacting system between aquatic and terrestrial situations, identified by soil characteristics, and distinctive vegetation that requires or tolerates free or unbound water. [7]

Riparian Zone An area of vegetation adjacent to an aquatic ecosystem. It has a high water table, certain soil characteristics, and some vegetation that requires free (unbound chemically) water or conditions that are more moist than normal. This zone is transitional between aquatic and upland zones. [7]

Roaded Natural Appearing Recreation Setting See Recreation Opportunity Spectrum (ROS).

Roadless Area A National Forest area which: a) is larger that 5000 acres or, if smaller that 5000 acres, contiguous to a designated wilderness or primitive area; b) contains no roads and c) has been inventoried by the Forest Service for possible inclusion in the Wilderness Preservation System.

Roadless Area Review and Evaluation (RARE II) A comprehensive process, instituted in June 1977, to identify roadless and undeveloped land areas in the National Forest System and to develop alternatives for both wilderness and other resource management.

Road Rehabilitation (Same as Road Obliteration) - Roads that serve no other resources will be obliterated and rehabilitated when oil and gas production ceases, (FSM 7731.6). Roadways will be ripped, plowed, or scarified and the slopes rounded to approximately the original contour (Engineer Manual, 7720-100LL, Section 210.01, page 83).

Rural Recreation Setting See Recreation Opportunity Spectrum (ROS)

S

Saline Water Water containing high concentrations of salt (see also brine water and brackish water).

Scoping Process An early and open public involvement process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. Identifying the significant environmental issues deserving of study and de-emphasizing insignificant issues, narrowing the scope of the Environmental Impact Statement accordingly. (Ref. CEQ Regulations, 40 CFR 1501.7).

"Scoria" (Porcellanite) A hard, dense, siliceous rock having the texture, dull luster, hardness, fracture, or general appearance of unglazed porcelain, often found in the roof or floor of a burned out coal seam. In North Dakota it is commonly used as a road surfacing material.

Section Broad areas of similar geomorphic process, stratigraphy, geologic origin, drainage networks, topography, and regional climate. Such areas are often inferred by relating geologic maps to potential natural vegetation "series" groupings. Boundaries of some Sections approximate geomorphic provinces (for example Blue Ridge) as recognized by geologists. Section names generally describe the predominant physiographic feature upon which the ecological unit delineation is based, such as Flint Hills, Great Lakes Morainal, Bluegrass Hills, Appalachian Piedmont. [8]

Sediment Solid mineral or organic material that is transported by air, water, gravity, or ice.

Seismic Exploration Seismic exploration is used to map underground geological features to obtain information on the earth's subsurface and to locate areas where accumulations of oil and gas might occur.

Seismic waves, generated at or near the surface, penetrate the earth's crust and reflect from subsurface rock layers back to the surface. The geophysicist receives a printed record or seismograph from which is measured the depth to various strata and from which subsurface structures with a potential for oil and gas accumulation can be determined such as faults, anticlines, and folds.

Seismic Operations Use of explosive or mechanical thumpers to generate shock waves that can be read by special equipment to give clues to subsurface conditions.

Semi-Primitive Recreation Setting See Recreation Opportunity Spectrum (ROS).

Sensitive Species Those plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations and will be managed similar to threatened or endangered species. The Forest Service policy is to ensure that species would not be affected in such a manner as to have them listed or proposed for listing as threatened or endangered.

Seral A biotic community which is developmental; a transitory stage (sere) in an ecologic succession.

Site An area of land large enough to be mapped, with specific soil characteristics such as water-holding capacity and available nutrients.

Small Game Birds and small mammals normally sport hunted or trapped .

Soil Productivity The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture and nutrients and length of growing season.

Sour Well In an oil or gas well, a condition caused by the presence of hydrogen sulfide or another sulfur compound.

Special Interest Area An SIA is an area with scenic, historic, geological, botanical, zoological, paleontological, or other special characteristics which is set aside to protect and, where appropriate, foster public use and enjoyment. This designation also serves to classify areas that possess unusual recreation and scientific values so that these special values are available for public study, use, or enjoyment (FSM 2360.2 Objectives). Candidate SIAs are those areas formally proposed for inclusion as potential RNAs, pending full analysis to determine if these areas meet all the requirements of RNAs. Until this criteria analysis is completed, all Candidate SIAs are to be managed as RNAs. Nominated SIAs are those areas to be considered for study for RNA status, but they have no specific management guidelines associated with them.

Species A population or series of populations of organisms that are capable of interbreeding freely with each other but not with members of other species. [7]

Split Estate A term that refers to different ownership of the surface and subsurface properties. For example, the Federal government may own the surface and a private person or persons may own the minerals underlying the parcel.

Standard Lease Terms and Conditions The terms and conditions contained in Bureau of Land Management Form 3100-11, Offer To Lease And Lease For Oil And Gas. This form contains the minimum terms and conditions to which stipulations and Lease Notices may be attached.

Step-Out Well A well drilled adjacent to or near a proven well to ascertain the limits of the oil or gas reservoir. An outpost is a well drilled a further distance from a step-out but still on the same structural trend. (Distance could be a couple of miles).

Stipulation (Stip) A provision that modifies standard lease rights and is attached to and made part of a lease.

Subregion Scale (Ecological Units) Subregions are characterized by combinations of climate, geomorphic process, topography, and stratigraphy that influence moisture availability and exposure to radiant solar energy, which in turn directly control hydrologic function, soil-forming processes, and potential plant community distributions. Sections and Subsections are the two ecological units mapped at this scale. [8]

Subsections Smaller areas of Sections with similar surficial geology, lithology, geomorphic process, soil groups, subregional climate, and potential natural communities. Names of Subsections are usually derived from geologic features, such as Plainfield Sand Dune, Tipton Till Plain, and Granite Hills. [8]

Sustainability The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time. [6]

Sustainable Development The use of land and water to sustain production indefinitely without environmental deterioration, ideally without loss of native biodiversity. [7]

Sustainable Ecological System Emphasizing and maintaining the underlying ecological processes that ensure long-term production of goods, services, and values without impairing productivity of the land. [7]

Sweet Well An oil or gas well lacking sulfur and any significant amount of hydrogen sulfide or mercaptans.

T

Tank Battery A group of production tanks that store crude oil in the field.

Terrestrial Ecosystem A land based ecosystem. An interacting system of soil, geology, topography with plant and animal communities. (See ecosystem.) [6]

Tiering Refers to the elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.

Timing Limitations (TL) Stipulation This stipulation (often called seasonal) prohibits fluid mineral exploration and development activities for time periods less than yearlong. A TL is not necessary if the time limitation involves the period of prohibition of new surface disturbing activities for less than 60 days (43 CFR 3101.1-2).

Threatened, Endangered and Sensitive Species (TES) Any species, plant or animal, which is likely to become a threatened or endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

Transportation Planning The identification of the transportation network through interdisciplinary analyses needed to effectively and efficiently meet land and resource management direction on a defined area for a specified planning period.

Travel Management Plan Provide travel opportunities for both motorized and non-motorized recreation activities on roads, trails, and areas that minimize adverse effects on the land and resources, that promote public safety, and that minimize conflicts with other users of NFS lands.

Two Track Roads Unsurfaced roads with no defined roadway, usually with only wheel tracks visible. These roads are excluded from the Highway Safety Act and are not intended or maintained for public travel with normal passenger cars.

Type Section The original sequence of strata as described for a given locality or area. It serves as an objective standard with which spatially separated parts of the stratigraphic unit may be compared, and is preferably in an area where the unit shows maximum thickness and is completely exposed (or at least shows top and bottom). There can only be one type section for each rock formation.

U

Understory The trees and other woody species which grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

V

Variety Classes An intermixing or succession of different things or qualities in a landscape such as dominance, form, color and texture.

Vascular Plants Plants with well-developed vascular systems that transport water, minerals, sugars, and other nutrients throughout the plant body. (Excludes the bryophytes; mosses, hornworts, and liverworts.) [6]

Viability The likelihood of continued existence in an area for some specified period of time. [6]

Viewshed A total landscape as seen from a particular viewpoint.

Visual Management System A management system that establishes the "visual landscape" as a basic resource, treated as an essential part of the land. The visual management system provides a framework to inventory the visual resource and provides measurable standards for its management.

Visual Quality Objective (VQO) A desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape as follows:

- Preservation: In general, human activities are not detectable to the visitor.
- Retention: Human activities are not evident to the casual Forest visitor.
- Partial Retention: Human activities may be evident, but must remain subordinate to the characteristic landscape.
- Modification: Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middle ground or background.
- Maximum Modification: Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.
- Enhancement: A short term management alternative which is done with the express purpose of increasing positive visual variety where little variety now exists.

Visual Resource The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

W

Waivers, Exceptions and Modifications to the Stipulations (WEM's) For those action alternatives that may require special stipulations, a waiver, exception or modification to the stipulation may be approved. A stipulation can only be waived or modified if "the record shows that circumstances or relative resource values have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impacts, and that less restrictive stipulations will protect the public interest." (Uniform Format for Oil and Gas Lease Stipulations, 1989). Conditions for a waiver, exception or modification are discussed under each stipulation in Appendix D.

Watch Species A plant species, or recognized subspecies or variety which meets the above definition of a sensitive species, but is not presently known to occur on National Forest land in North Dakota. These taxa, are predicted to occur on National Forest land on the basis of suitable habitat. If found on National Forest land, these taxa would immediately be evaluated for placement on the sensitive species plant list. [2]

Wildcat Well An exploratory well drilled in an area where there is no oil or gas production.

Wilderness An area designated by Congress as part of the National Wilderness Preservation System. Wilderness areas are generally undeveloped Federal lands that retain their primeval character and influence without improvements or human habitation. [5]

Wetlands Those areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs. [1]

Woody Draw A classification of areas, particularly in grassland settings, where an overstory of woody vegetation in small drainages creates habitat for many wildlife species and shade/wind protection and forage for livestock. The vegetation is a result of higher moisture conditions than in the surrounding areas but surface water if any, running thru the areas is generally short term. [1]

[1] Source: Glossary found on pages 121 through 148 of the Custer National Forest Management Plan, October 1986.
[2] (USFS, 1991 June, p. 1)
[3] Source: FSM - WO Amendment 2600-91-8, Effective 10/22/91, p. 9 - 13.
[4] Source: USFS, 1992. Our approach to sustaining ecological systems. USDA, USFS, Northern Region, Missoula, MT. R1-92-23. 26 pp.
[5] Glossary in Custer National Forest Noxious Weed Treatment program DEIS, Feb. 1986.
[6] Source: Draft EM Keywords and Definitions (2/7/94). C.CARTWRIGHT:WO
[7] Source: Draft Ecosystems Management Glossary (5/20/93). Reply to: 1330-1/2400, (s) J. Lowe, Regional Forester, USFS R-6, PNW Station.
[8] Source: Draft National Hierarchical Framework (11/05/93). Reply To: 1330/2060. (s) D.Unger. Acting Chief, USFS WO.
[9] Source: Jensen, M.E. and P.S.Bourgeron. April 1993. Eastside Forest Ecosystem Health Assessment. IN: Volume II, Ecosystems Management: Principles and Applications. USFS, R-1. pp. 389
[10] Source: Kohm, K. A. Balancing on the brink of extinction: the Endangered Species Act and lessons for the future. Island Press, Washington, D. C., 318 pp.
[11] Source: USFS, July 1992, Draft. Ecosystem Management Strategies for the East and Midwest: A report to the Chief of the Forest Service. Eastern Region. 27 pps.
[12] Source: SAF, Feb. 11, 1994. Draft silviculture terminology, Society of American Foresters, 8 pp.

LIST OF ACRONYMS USED IN THIS DOCUMENT

ACC	Areas of Critical Concern
ACEC	Areas of Critical Environmental Concern
AIRFA	American Indian Religious Freedom Act
APD	Application for Permit to Drill
AQB	Air Quality Bureau
AQRV's	Air Quality Related Values
ARPA	Archaeological Resources Protection Act
AUM	Animal Unit Month
BA	Biological Assessment
BACT	Best Available Control Technology (Air)
BE	Biological Evaluation
BLB	Badlands on the Brink (Pub)
BLM	Bureau of Land Management
BMP	Best Management Practices
BOP	Blowout Preventer Valves
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	Code of Federal Regulation
CNF	Custer National Forest
CNFMPS	Custer National Forest Management Plan Standards
COA	Conditions of Approval
CRMP	Conservation Reserve Management Program
CRNG	Cedar River National Grasslands
CSU	Controlled Surface Use
CWA	Clean Water Act
DIES	Draft Environmental Impact Statement
DEM	Digital Elevation Models
DFC	Desired Future Condition
DSL	Department of State Lands
EA	Environmental Assessment
EM	Ecosystems Management
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAN	Final Advancement Notice
FDR	Forest Development Road
FEIS	Final Environmental Impact Statement
FLPMA	Federal Land Policy and Management Act
FOOGLRA	Federal Onshore Oil and Gas Leasing Reform Act of 1987
FP	Forest Plan
FS	Forest Service
FWS	Fish and Wildlife Service
GIS	Geographic Information System
GPS	Global Positioning System
GRNG	Grand River National Grassland
IDT	Interdisciplinary Team
IRA	Inventoried Roadless Area
LA	Landtype Association
LMNG	Little Missouri National Grassland
LRMP	Land and Resource Management Plan
LGST	Local Government Severance Tax
LN	Lease Notice
MA	Management Area
MBEWG	Montana Bald Eagle Working Group
MCF	One Thousand Cubic Feet - Units of Gas
MDU	Montana-Dakota Utility Company
MIS	Management Indicator Species
MMBO	Million Barrels of Oil
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MU	Multiple Use
MYA	Million Years Ago
NA	Not Available
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NDDPR	North Dakota Department of Parks and Recreation
NDGF	North Dakota Game and Fish Department
NDGS	North Dakota Geological Survey
NDSDH	North Dakota State Department of Health
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System (lands)
NHPA	National Historic Preservation Act
NIA	Notice of Intent to Abandon
NL	No Lease
NLMR	Northern Little Missouri River
NOS	Notice of Staking
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NTL	Notice to Lessee
OPI	Office of Public Instruction
ORV	Off Road Vehicle
PAOT	Persons At One Time
PED	Production Extensive Deed
PNC	Potential Natural Community
PSD	Prevention of Significant Deterioration
PUE	Planning Unit Ecosystem
RARE II	Roadless Area Review and Evaluation II
RD	Ranger District

RFD	Reasonably Foreseeable Development
RMP	Resource Management Plan
RNA	Research Natural Area
RO	(FS) Regional Office
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
RPA	Resource Planning Act
RPA	Resource Protection Act
RVD	Recreation Visitor Day
SHPO	State Historic Preservation Office
SIA	Special Interest Area
SIP	State Implementation Plans
SLM	Southern Little Missouri
SLT	Standard Lease Terms
SMA	Surface Management Agency
SO	(FS) Supervisor's Office
SOD	Self Operative Deed
SRA	Subsequent Report of Abandonment
T & E	Threatened and Endangered Species
TES	Threatened and Endangered Species
TIS	Transportation Inventory System
TL	Timing Limitations
TRNP	Teddy Roosevelt National Park
TSP	Total Suspended Particulates
UIC	Underground Injection Control
UND	University of North Dakota
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VQL	Visual Quality Levels
VQO	Visual Quality Objective
WEM	Waiver, Exception or Modification
WPA	Works Progress Administration

LIST OF PREPARERS

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

LIST OF PREPARERS

The following list includes the individuals who contributed in the preparation of the SLM EIS.

Name	Expertise	Education
■ INTERDISCIPLINARY PLANNING TEAM		
Custer National Forest Supervisors Office		
Greg Visconty	ID Team Leader, Geologist	B.S., M.S. Geology
Carol McCoy Brown	Geologist	M.S. Geology, Post-Grad Natural Resources Mgmt.
Don Sasse [1]	Wildlife Biologist	B.S., M.S. Wildlife Biology
Vickey Murfitt	NEPA/Appeals Coordinator	A.A. Science & Business
Sue Karges	Editorial Assistant, 3/93-5/94	A.A. Publication/Design B.A. Education
Barbara Smith	Editorial Assistant, 10/94-12/94	Office Publisher Expert
Rita Shultz	Editorial Assistant, 1/95-3/95	B.S. Computer Science
Custer National Forest - Medora Ranger District		
Brenda Quale	Range Conservationist	B.S. Animal & Range Science
Gary Richtmyer	Minerals Tech	B.S. Recreation
USDI, Bureau of Land Management		
Gene Campbell	Asst. Dist. Manager Minerals Resources	B.A. Geology
John Bown	Minerals Planner & Environmental Specialist	B.S. Geology M.S. Geology
Deerlodge National Forest		
Boje Nielsen	Forest Landscape Architect	AAS, B.S., MLA. Landscape Architecture
Lolo National Forest		
Fred Stewart	Economist	B.S. Wildlife Biology, PhD. Economics
■ USDA FOREST SERVICE TECHNICAL SUPPORT		
CNF Beartooth R.D. (D-2)		
Chuck Mark	Forester	B.S. Resource Conservation
CNF Grand River R.D. (D-6)		
Forest Morin	District Ranger	B.S. Forest/Range Management
Bob Anderson	Range Technician	Technician
Jeff Tomac	Range Conservationist	B.S. Range Science

CNF Medora R.D. (D-7)

Norm Bishop	Lead Forestry Technican	Technician
Lu Burger	Range Conservationist	B.S. Forestry/Range Science
Frank Heisner	Forestry/Range Technician	B.S. Forestry
Bill Kurtz	Archaeologist	M.A. Anthropology
Jim Pfau	Transportation Engineer	B.S. Civil Engineering
Sam Redfern	District Ranger	B.S., M.S. Forestry/Range
Susan Rinehart [1]	Botanist	B.S. Range Science - B.A. Political Science/History
Phil Sjursen	Range Conservationist	A.S. Forestry B.S. Range Science
Robert Wiegand	Forester	B.S. Wildlife

CNF McKenzie R.D. (D-8)

Gary Foli	Wildlife Biologist	B.S. Biology
Mervin Floodman	Archaeologist	M.A. Archaeology

Custer National Forest Supervisors Office

Cheri Bashor	Forest Range Staff	B.S. Range Ecology
Curtis W. Bates	Forest Supervisor	B.S. Range Forestry
David Card	Computer Specialist	Technician
Gary Coats	Civil Engineering Technican	Technician
Nancy T. Curriden	Forest Supervisor	B.A. English, M.A. Anthropology/ Archaeology
Jeff DiBenedetto	Ecologist	B.S. Range Management
Carl Fager	EIS Coordinator	B.S.M.F. Forestry
Jim Fishburn	Forest Program Manager - Resources	B.S. Forestry (Range Management)
Ken Gehman	Visual Information Specialist	Technician
Jim Gray	Asst. Forest Planner	B.S. Forestry
Halcyon LaPoint	Archaeologist	M.A. Archaeology
Mary Lunsford	Secretary, Asst. PAO	Secretarial
Clint McCarthy	Wildlife Biologist	B.S. Wildlife Management
Sherry Milburn	Public Affairs Officer	B.S. Biology, M.S. Counseling
Lee McConnel	Soil Scientist	B.S. Forest Management
Susan Newell	Realty Specialist	B.S. Ag, M.S. Education
Rodd Richardson	Acting Forest Supervisor	B.S. M.S. Wildlife Biology
Leroy White	Forest Program Manager - LMP	B.S. Forestry

Gallatin National Forest

Bruce May [1]	Zone Fisheries Biologist	B.S. Zoology, M.S. Fisheries Science

Regional Foresters Office

Terry Egenhoff	General Biologist/ Environmental Coordinator	B.A. Biology - M.S. Environmental Studies
Ed Heist	Forester, NEPA Specialist	B.S. Recreation
Richard C. Marshall	Mineral Economist	PhD. Mineral Economics
Barb Plattes	Land Law Examiner	B.A. Education
Cheryl Stickney	Land Law Examiner	Leasing Specialist
Leslie Vaculik	Leasable Minerals Specialist	B.S. Chemical Engineering - MBA

■ USDI, BUREAU OF LAND MANAGEMENT TECHNICAL SUPPORT

James Albano	Minerals Resource Specialist	B.S. Range Science
Tim Bozorth	Hydrologist	B.A. Aquatic Biology
Kevin Brooks	Computer Operator	B.S. Natural Resource Mgmt.
Sheila Cain	Cartographic Technician	Technician
Becky Casillas	Cartographic Technician	Technician
James Chapman	Geographer	B.S. Natural Resource Planning
Richard Hotaling	Petroleum Engineer	B.S. Geological Engineer
Judy Huether	Cartographic Technician	Technician
Pat Ives	Cartographic Technician	Technician
Lee Jefferis	Geologist	M.S. Geology
Kathy Jewel	Computer Systems Manager	Technician
George Long	Geologist	B.A. Geology
Allen Ollila	Petroleum Engineer	B.S. Chemical Engineer
Randy Shardt	Cartographic Technician	Technician
Keith White	Cartographic Technician	Technician
Burton D. Williams	Chief/Branch of Information Resources Management	B.A. Anthropology
Chuck Sigafoos	Supervisory Cartographic Technician	Certified Drafting Technician

■ AGENCY/GROUP/INDIVIDUAL CONSULTATION

• FEDERAL

U.S. Fish & Wildlife Service

Ken Sanchez	Wildlife Biologist	Bismarck, ND
Roger Collins	Supervisory Wildlife Biologist	Bismarck, ND

• STATE

North Dakota Game & Fish Department

Bill Jensen, Ph.D.	Wildlife Biologist	Bismarck, ND
Ron Stromstad	Wildlife Biologist	Bismarck, ND

• COLLEGE AND UNIVERSITY

Dr. Robert Seabloom	University of North Dakota	Bismarck, ND
Dr. Earl Willard	University of Montana	Missoula, MT
Dr. Rick Ringleb	University of Montana	Missoula, MT

[1] Preparer of the Biological Evaluation (USFS Sensitive Species) incorporated into Chapter III and IV, and the Biological Assessment (Federally Listed Threatened and Endangered Species), Appendix I.

APPENDIX A

PROJECT FILES SUMMARY

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX A

A. PROJECT FILES SUMMARY

VOLUME 1
1. Forest Plan
   - A. Amendments
   - B. Management Direction
2. Public Involvement/Scoping
   - A. Scoping Document
   - B. Responses to Scoping Documents
     1. Phone Calls in Reference to Scoping

VOLUME 1A
   - C. Coded Response Letters
   - D. Analysis of Public Response

VOLUME 2
3. General Administration
   - A. Notice of Intent
   - B. Federal Register
   - C. NEPA Compliance
   - D. News Releases
   - E. Mailing Lists
   - F. Issues to be Addressed
   - G. Newsletter
   - H. Responsible Officials/Decisions
   - I. Memorandums of Understanding
   - J. ID Team
   - K. Progress Reports

VOLUME 3
   - L. Meeting Notes

VOLUME 3A
   - M. Status Reports
   - N. Synopsis of EIS
   - O. Schedules

VOLUME 4
4. Geographic Information Systems
   - A. Meeting Notes
   - B. Contracts-MOU
   - C. Background Data
5. Ecosystems Mgmt/Landscapes
   - A. Climate
6. Land Ownership

VOLUME 5
7. Oil & Gas
   - A. Geology
   - B. RFD
   - C. BLM Policy

VOLUME 6
   - D. Stipulations
   - E. Split Estates
   - F. Other/Mineral Ownership

VOLUME 7
8. Transportation System
   - A. Roads and Trails
   - B. Forest Orders Restricting Motor Vehicle Travel
9. Roadless (Issue 1)
   - A. Inventoried
   - B. Proposals
10. RNA's/SIA's (Issue 2)
    - A. Established RNA
    - B. SIA's

VOLUME 8
11. Biodiversity (Issue 3)
    - A. Vegetation
      1. Grasslands
      2. Riparian
      3. Woody Draws
      4. Ponderosa Pines
      5. Noxious Weeds

VOLUME 9
    - B. T & E Species
      1. Prairie Dog/Ferret Habitat
    - C. Sensitive Species

VOLUME 10
      1. Animals
         - a. Ferruginous Hawk
         - b. Bighorn Sheep

VOLUME 11
         - c. Sage Grouse
         - d. Mountain Plover
         - e. Baird's Sparrow
         - f. Butterflies

VOLUME 11A
         - g. Belfragi's Chlorochroan Bug
         - h. Fish
         - i. Bats
         - j. Flammulated Owl
      2. BLM Sensitive Species
      3. Plants
    - D. Watch Plants
    - E. Management Indicator Species
      1. White-tailed Deer
      2. Sharp-tailed Grouse

VOLUME 12
    - F. Key Species
      1. Elk
      2. Golden Eagle
      3. Prairie Falcon
      4. Merlin
      5. Pronghorn Antelope
      6. Wild Turkey
      7. Pheasant

VOLUME 12A

- G. C2 Candidate Species
  - 1. Swift Fox
  - 2. Fish
- H. Neotropical Migrant Birds
- I. Canyonlands

VOLUME 13

- J. Mule Deer Habitat

VOLUME 13A

- K. Unique Communities
- L. Genetic Diversity
- M. Structure/Fragmentation/Corridors

VOLUME 14

- 12. Moody Plateau Bighorn Sheep Study (Issue 4)
- 13. Visuals/Recreation (Issue 5)
  - A. Visuals
  - B. Recreation
    - 1. Hunting
    - 2. Little Missouri River
- 14. Economic Stability (Issue 6)

VOLUME 15

- 15. Additional Issues
  - A. Public Safety
  - B. Air Resource

VOLUME 15A

- C. Water Resource
- D. Fire
- E. Soils
- F. Land Uses
  - 1. Livestock Grazing

VOLUME 16

- G. Heritage
- H. Paleontology
- I. Steep Slopes

VOLUME 17

- 16. Cedar River Information
- 17. NDGF PAMA
- 18. Response to Comments of Draft/Draft
- 19. Response to Public Comments of DEIS
  - A. Mailing Lists
    - 1. Proof of Delivery
    - 2. Specific Cover Letters
    - 3. Distribution of DEIS
  - B. Briefing
  - C. Open House
  - D. Letters Requesting Longer Comment Period

VOLUME 18

- E. Comment Letters
- F. Analysis of Public Comments

VOLUME 19

- 20. GIS Maps produced for the FEIS

APPENDIX B

ACTS OF AUTHORITY AND MANDATES FOR THE FOREST SERVICE AND BUREAU OF LAND MANAGEMENT

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX B

A. ACTS OF AUTHORITY AND MANDATES FOR THE FOREST SERVICE AND BUREAU OF LAND MANAGEMENT

The authority of the Authorized Officer to make these decisions is conferred by the Leasing Reform Act of 1987. The implementing regulations gave the authority to make these decisions to Regional Foresters. The Regional Forester has delegated that authority to the Supervisor of the Custer National Forest. Other acts are mandates to the Forest Supervisors that must be carried out while implementing any activities on the ground.

■ BACKGROUND ACTS

A series of statutes prior to the Leasing Reform Act further establish and define the authority of the Supervisor to make these decisions. These are:

General Mining Law of 1872 (later amended by the Mineral Leasing Act of 1920)

Public lands, including National Forest System lands, valuable for oil deposits were open to entry and placer mining claims under the General Mining Law. (See Act of February 11, 1872, 29 Stat. 526.) The General Mining Law of 1872 (30 USC 22-54) preceded the Organic Act and the establishment of the Forest Reserves and National Forests. The General Mining Law governs mining activity on public lands and National Forest System lands.

So many claims were filed under the General Mining Law that the President issued a Proclamation in 1909 withdrawing public lands from such entry, pending the enactment of legislation to protect such lands. (See *U.S. v. Midwest Oil Co.*, 59 L.Ed. 673 (1915), and *Udall v. Tallman*, 13 L.Ed. 2d 616, 628 (1965)). However, protective legislation was not enacted until the Mineral Leasing Act of 1920. (See *Boesche v. Udall*, 373 US 472, 10 L.Ed. 2d 491, 497 (1963).) This Act authorizes the Secretary of the Interior to issue leases for disposal of certain minerals (currently applies to coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The Act applies to National Forest System lands reserved from the public domain.

Mineral Resources on Weeks Law Lands

The Act of March 4, 1917 (39 Stat. 1150, as supplemented; 16 U.S.C. 520); this act authorizes the Secretary of the Interior to prescribe general regulations to permit prospecting, development, and use of the mineral resources of the lands acquired under the Act of March 1, 1911, known as the Weeks Law, for the best interests of the United States.

Bankhead-Jones Farm Tenant Act of 1937

(Act of July 22, 1937 (P.L. 75-210), Ch 517, 50 Stat. 522, as amended; 7 U.S.C. 1010-1012)

In 1929 Congress recognized the problem of submarginal land (grasslands in the Great Plains area that were found to be inappropriate for plowing and cropping) and enacted legislation to make investigations and reports on land utilization for agricultural purposes. As a result, recommendations were made for the acquisition, retention and management of submarginal lands by the Federal government.

In 1934, a submarginal land purchase program was instituted by the Agricultural Adjustment Administration and purchase areas were designated. The purchase areas were throughout the Great Plains; ones damaged by plowing and affected by the Dust Bowl eara. A series of executive orders created administration and management guidelines for the Land Utilization Project areas, as they were called.

In 1937, The Bankhead-Jones Farm Tenant Act was passed to provide a more permanent status for the Land Utilization Program. Bankhead-Jones is currently used to manage Federal lands which have National Grassland status.

Act of July 22, 1937 (P.L. 75-210), Ch 517, 50 Stat. 522, as amended; 7 U.S.C. 1010-1012)

"Sec. 31. The Secretary is authorized and directed to develop a program of land conservation and land utilization, in order thereby to correct maladjustments in land use, and thus assist in controlling soil erosion, reforestation, preserving natural resources, protecting fish and wildlife, developing and protecting recreational facilities, mitigating floods, preventing impairment of dams and reservoirs, developing energy resources, conserving surface and subsurface moisture, protecting the watersheds of navigable streams, and protecting the public lands, health, safety and welfare but not to build industrial parks or establish private industrial or commercial enterprises. (7 U.S.C. 1010)."

Reorganization Plan No. 3 of 1946

Part IV, Section 402 (60 Stat. 1097, 1099; 5 USC Appendix). This Plan provides that development of mineral deposits in certain lands pursuant to provisions of the Mineral Resources on Weeks Law Lands Act of March 4, 1917 (Ch. 179, 39 Stat. 1134, 1150, 16 USC 520) shall be authorized by the Secretary of the Interior only when he is advised by the Secretary of Agriculture that such development will not interfere with the primary purposes for which the land was acquired and only in accordance with such conditions as may be specified by the Secretary of Agriculture in order to protect such purposes.

Energy Security Act of June 30, 1980

The Energy Security Act (P.L. 96-294, 94 Stat. 611; 42 USC 8801 (note), 8854, 8855) directs the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on National Forest System lands, notwithstanding the current status of the land and resource management plan.

■ ACTS OF AUTHORITY

Mineral Leasing Act for Acquired Lands of August 7, 1947

The Mineral Leasing Act (Ch. 513, 61 Stat. 913; 30 USC 351, 352, 354, 359) provides that all deposits of coal, phosphate, oil, oil shale, gas, sodium, potassium, and sulphur that are owned or may be acquired by the United States and that are within the lands acquired by the United States may be leased by the Secretary of the Interior under the same conditions as contained in the leasing provisions of the mineral leasing laws. No mineral deposit covered by this section shall be leased except with the consent of the head of the executive department, independent establishment, or instrumentality having jurisdiction over the lands containing such deposit, or holding a mortgage or deed of trust secured by such lands that is unsatisfied of record, and subject to such conditions as that official may prescribe to ensure the adequate use of the lands for the primary purposes for which they have been acquired or are being administered.

The Federal Onshore Oil and Gas Leasing Reform Act Of December 22, 1987

The 1987 Leasing Reform Act (30 USC 181, et seq.; P.L. 100-203) expanded the authority of the Secretary of Agriculture in the management of oil and gas resources on National Forest System lands and directed the Secretary to issue rules on bonding and reclamation standards. Under the Act, leases for oil and gas on National Forest System lands cannot be issued by the BLM without the approval of the Forest Service. All surface-disturbing activities on National Forest System lands must be approved by the Forest Service before operations commence. The Act also provides for inspections and enforcement of operations once commenced. Regulations implementing this statute were published in the *Federal Register* by the Forest Service on March 21, 1990 (55 FR 10423, et. seq.). The regulations were codified in 36 CFR 228.100 et. seq.

Mineral Leasing Act of February 25, 1920

"The Bureau of Land Management, Department of the Interior, is responsible for leasing under this Act. Technical administration of leases and permits is the responsibility of the U.S. Geological Survey. By interdepartmental agreement all applications to lease lands under Forest Service Jurisdiction are referred to the Forest Service for review, recommendation, and special stipulations to protect the surface and surface functions."

■ MANDATES

Organic Act

The Organic Act of June 4, 1897 (16 USC 475) established the system of Forest Reserves, which later became the National Forest System. This act defines and describes the basic purposes for which National Forests (and later, National Grasslands) are to be managed. The Act provides in part that

> "...it is not the purpose or intent of these provisions, or of said section, to authorize the inclusion therein of lands more valuable for the mineral therein, or for agricultural purposes, than for forest purposes" (Chpt. 2, Sec. 1, (30 Stat. 34)).

Provision is made for regulations allowing free use of timber and stone for bona fide miners and prospectors in 16 USC 477. Authority for regulations providing access for prospecting, locating, and developing mineral resources is found in 16 USC 478.

The General Mining Law of 1872 (30 USC 22-54) preceded the Organic Act and the establishment of the Forest Reserves and National Forests.

Multiple-Use Sustained-Yield Act of 1960

The Multiple-Use Sustained-Yield Act of 1960 (16 USC 528) extended the purposes for which lands of the National Forest System could be managed. It also declared that these lands be managed for multiple uses, rather than for individual uses in individual places. Management of the individual natural resources of the lands is declared to be according to the principle of sustained yield in perpetuity. This Act provides, in part, that:

> "Nothing herein shall be construed so as to affect the use or administration of the mineral resources of national forest lands ..."

National Forest Management Act of 1976

This statute (16 USC 1600, et. seq.) and its implementing regulations (36 CFR Part 219) define additional principles for management of the lands and resources of the National Forest System. This Act also directs the Forest Service to create Land and Resource Management Plans for each administrative unit of the National Forest System. The Plans are:

> "to provide for multiple use and sustained yield of goods and services from the National Forest System in a way that maximizes net public benefits in an environmentally sound manner" (36 CFR 219.1(a)).

The Act describes required management of renewable resources, but indicates that mineral exploration and development must be considered in the planning and management relating to the renewable resources (36 CFR 219.22).

These authorities, and the discretion of the Forest Supervisor in making these decisions, are conditioned by several other statutes. The basic laws that limit the discretion of the Supervisor to make these decisions are described below.

National Environmental Policy Act

This statute (40 USC 4331 et. seq.) and its implementing regulations (40 Part 1500) apply to Federal actions relating to oil and gas leasing. This statute requires the Federal Authorized Officers in the Forest Service and other Federal Agencies to perform an environmental analysis and disclose the effects of their decisions on the quality of the human environment. The law further requires the Federal Officers to identify and describe the significant environmental issues associated with his/her decision and to develop alternatives to his proposed

action (including the alternative of no action). Federal Officers must disclose the direct, indirect, and cumulative effects of the decisions, and adverse environmental effects that cannot be avoided, the relationship between short-term uses of man's environment and the maintenance of long-term productivity, and any irreversible or irretrievable commitments of resources made by the decision.

The Clean Air Act of 1970

The Clean Air Act (91 Stat. 685; 42 U.S.C. 7401 et. seq.) provides that each State is responsible for ensuring achievement and maintenance of air quality standards within its borders so long as such standards are at least as stringent as Federal Standards established by the U.S. Environmental Protection Agency (EPA).

The Endangered Species Act of 1973

The Endangered Species Act (Public Law 93-204; 16 USC 15311, et. seq.), as amended, requires special protection and management on Federal lands for threatened or endangered species. The U.S. Fish and Wildlife Service (FWS) is responsible for administration of this act. Federal agencies proposing an action or processing an action proposed by a third party which "may affect", in any way, the existence of an identified species must consult with the FWS to determine if, and how, the proposed action will affect those species. Mitigation measures will be developed through the consultation process and are put forth as suggested conservation measures included a formal "FWS Biological Opinion" as to whether or not the proposed action would jeopardize the continuous existence of any officially listed endangered or threatened species.

Clean Water Act

Clean Water Amendments ("Federal Water Pollution Control Act Amendments of 1972"); Act of October 18, 1972 (P.L. 92-500, 86 Stat. 816, as amended; 33 USC 1251, et seq.)-the act puts forth national standards to restore and maintain chemical, physical and biological integrity of the Nation's waters. Upon passage of Environmental Quality Acts and adoption of water quality standards, state agencies were empowered to enforce water quality standards as long as they are at least as stringent as Federal standards established by the EPA.

Historic Preservation Act

The National Historic Preservation Act is Public Law 89-665, 80 Stat. 915 (16 USC 470) as amended. Section 106 of the Act requires a Federal agency planning an undertaking to consider the effects of the action on cultural resources eligible to, or listed on, the National Register of Historic Places. Prior to the approval of the undertaking the agency must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

Resource Planning Act of 1990

The 1990 Resource Planning Act (RPA) established National policy for oil and gas development on Federal lands based on a fifty year projection into the future. The Forest Service has defined nine roles in its basic National strategic plan. Multiple-use management, contributions to rural development, and management in situations of mixed ownership situations are three of those roles. The issue of minerals development is described in the 1990 RPA document as:

> "The mineral resources within the National Forest System significantly affect the economic well-being of local communities and the strategic defense of the Nation. The public is concerned about the effects on minerals development on other resource values and on the environment."

In the 1990 RPA program, the long-term strategy for minerals is to meet most demands for access to explore and develop mineral resources, except when doing so would pose unacceptably high risks to other resources.

Energy Policy Act of 1992

Changed the primary term of competitive leases from five years to ten years.

Federal Land Policy and Management Act of 1976

This statute 43 USC 1700; el. seq.) and its implementing regulations define principals for management of public lands and their resources. This act directs the Secretary of Interior to develop, maintain, and, when appropriate, revise Land Use Plans which provide for the use of public lands and that management bon on the basis of multiple use and sustained yield unless otherwise specified by law.

APPENDIX C

OIL AND GAS EXPLORATION, DEVELOPMENT, AND PRODUCTION

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

OVERVIEW

The following description of oil and gas activities is a general coverage of the topic provided for the readers benefit. It is basically a primer on the subject. It is not intended to represent what would happen if oil and gas development should occur in the project area covered by this EIS. If leasing occurs, some or all of the phases and activities described may or may not occur, and if they do, some combination of the activities described for each phase and activities will also occur. New technologies are coming on line continuously and some of the activities described may change or be replaced by the new technology. hopefully, this section will give the reader that has not been exposed to oil and gas activities at least a basic understanding of the complexity of the subject and an appreciation for the difficulty in analyzing a subsurface resource.

APPENDIX C

Oil and Gas Exploration, Development, and Production

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Once an oil and gas lease is issued, the lessee or his designated operator may enter upon the leasehold to conduct oil and gas operations unless otherwise limited by special stipulations. The following depicts what can be expected to occur and, therefore, assumed will occur for the purposes of this analysis when oil and gas is discovered and development of a lease is undertaken. It is also assumed that the technology of oil and gas exploration and development will not change significantly during the life of this document. This section is an integral part of the assumptions made in Chapter II.

Successful oil and gas exploration and development generally progresses through five basic operational phases. These include: (1) preliminary investigation (includes geophysical exploration), (2) exploratory drilling, (3) development, (4) production, and (5) abandonment (See Figure 1). Several operational phases can occur in the same area at the same time. One company may drill an exploratory well on a lease while nearby another company conducts preliminary investigations. However, if only one company is conducting operations in an area, normally only one phase of the operation will take place at a time. A lapse of several months or perhaps years may occur between the preliminary investigation and exploratory drilling phases. A lapse of several weeks or months may also occur between the exploratory drilling and development phases. The development and production phases may occur simultaneously, especially if a large field has been discovered. On an average, only one out of 10 exploratory oil and gas wells wells drilled in the United States is successful.

It may take several years to determine whether an exploratory well is a financial success. If it is a success, the operations progress through the three remaining phases over a timespan ranging up to 50 years.

The lapse time between the production and abandonment phases of a field may be 15 to 20 years. If geophysical exploration and/or exploratory drilling are unsuccessful in the discovery of a commercial deposit of oil and gas, operations are terminated and abandonment is initiated. The operation may also go directly from development to abandonment if one or more of the development wells is unsuccessful.

A. PRELIMINARY INVESTIGATIONS (PHASE 1)

Indications of the presence of oil and gas can be obtained by exploration methods such as remote sensing and the mapping of rock outcrops and seeps. In many cases indirect methods, such as seismic, gravity, and magnetic surveys are used to delineate subsurface features which may contain oil and gas.

1. Permitting Process

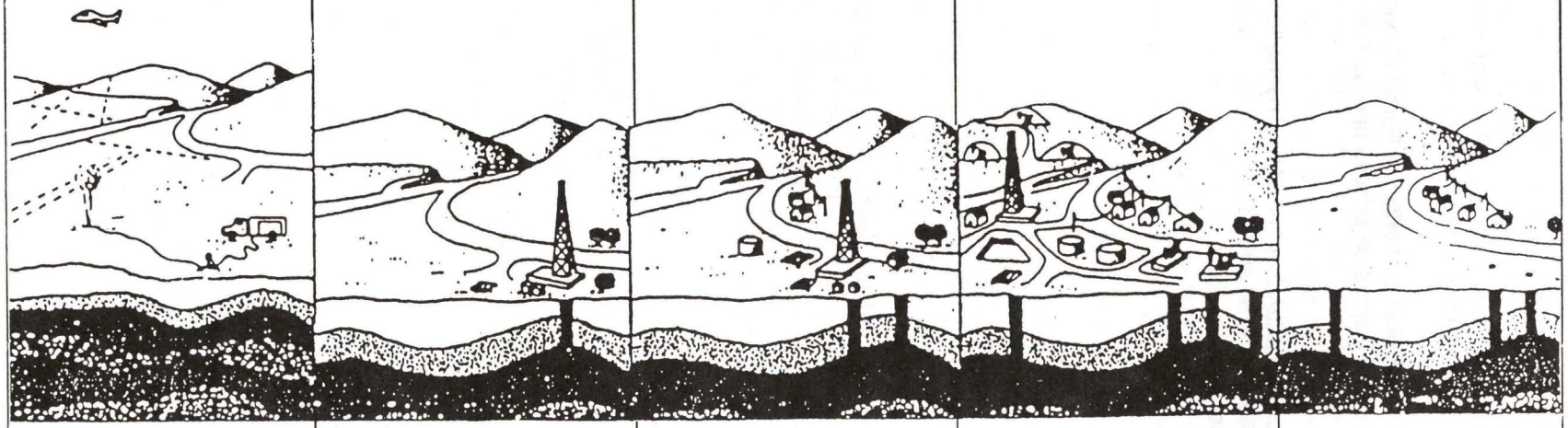
Geophysical exploration (seismic reflection surveys) on National Forest System (NFS) lands is authorized under a prospecting permit issued by the Forest Service. However, geophysical operations within the leasehold may be conducted by the lessee under the terms of the oil and gas lease without a Forest Service prospecting permit. Proposals for geophysical operations on and off an oil and gas lease are examined by the Forest Service prior to being approved or authorized. Most casual use investigation methods, such as geological, gravity, geomagnetic, and geochemical surveys do not require a permit since no surface disturbance occurs and only a "casual" presence on the land surface is required to conduct the operations.

In order to secure a permit for operations on NFS lands, the geophysical operator is required to file, in person or by mail, an application for a prospecting permit. The application must describe the proposed activities in detail and include a map showing access routes and location of exploration activities. Upon receipt of the application, the Forest Service reviews the proposed activities to determine the stipulations necessary to protect surface uses and resources. After the Forest Service reviews the application, a permit is prepared. The operator is sent the prospecting permit indicating the stipulations, fee to be paid (if applicable), and amount of bond required. The operator must sign and return the permit with fee and bond required prior to receiving a permit. A permit is not required for casual use investigations.

FIGURE 1

SEQUENCE OF OPERATIONS IN AN OIL AND GAS FIELD

PRELIMINARY INVESTIGATION	EXPLORATION	DEVELOPMENT	PRODUCTION	ABANDONMENT
(Unknown Geologic Structure) Preliminary Investigations are carried out over large areas from aircraft and on the ground.	If the preliminary investigations indicate geologic structures may contain oil and gas, a lease is obtained and an exploratory well is drilled.	If oil and gas are discovered during the exploration phase and recovery is economically feasible, the field is developed for production.	The production phase involves operation and maintenance of the field and recovery of oil and gas.	When the field is abandoned, equipment is removed, wells are plugged, and the surface is reclaimed.



Airborne Surveys Surface Surveys Geochemical Surveys Stratigraphic & Other Mapping Explosive Method Thumper Method Vibrator Method Gravity & Other Method Geologic Survey	Wildcat Well Drilling Access Roads Camp & Buildings (Remote Areas) Geophysical Surveys	Development Drilling Access Roads Pipelines Utility Lines Seperators Storage Tanks Camps & Buildings	Continued Drilling & Development of Field Pressure Maintenance System Disposal of Waste Secondary & Tertiary Recovery Systems Communications & Production System Communities	Equipment, Buildings & Facilities Removal Field Cleanup Well Abandonment & Plugging Eliminate Hazard Surface Reclamation Landscaping Reseeding Other Erosion Control

Source: BLM 1986, Pinedale RMP

The operator must receive approval of a prospecting permit prior to initiating operations outside a lease. The operator must also notify the Forest Service of the scheduled entry onto the land, must comply with all stipulations, and receive prior approval of any changes in the original plans. A prework conference and a cultural resources survey may be required prior to undertaking surface disturbing activities. Compliance inspections are conducted by the Forest Service during exploration operations to ensure compliance with the permit and to prevent unnecessary damage to the surface resources.

The geophysical operator is required to notify the Forest Service when operations are completed. The Forest Service conducts a final inspection prior to approval of termination of the permit and release of the bond.

Geophysical exploration on public lands administered by the BLM requires review and approval following the procedures found at 43 CFR 3150 and 3151. The operator is required to file a Notice of Intent (NOI) to conduct Oil and Gas Geophysical Exploration Operations with the District Manager of the proper BLM office, (for North Dakota, this is the Dickinson District Office). All further parts of the permitting process are basically the same as those described for the Forest Service.

2. Geologic and Remote Investigations (Surveys)

Geologic investigation begins with a review of geologic and technical data available for the area of interest. If the data indicates a potential for oil and gas, information for specific areas or trends are evaluated. If the area does not have a producing history and no previous exploratory oil and gas wells have been drilled, an extensive geophysical exploration program covering a large area may be undertaken to collect the subsurface data in order to evaluate the oil and gas producing potential.

Remote investigations may be conducted either from the air or on the ground. These are preliminary investigations which involve only casual use and no permits are required. However, the investigators must comply with the Forest Service or BLM rules and regulations. The oil and gas lease does not grant an exclusive right to conduct remote investigations and geophysical exploration. These activities may be conducted prior to, or after, leasing by either the lessee or someone other than the lessee. These investigations may result in an expression of interest to lease specific areas.

Geological Surveys - Geological surveys normally are a casual use. Rock outcrops and topography are examined to determine the structural attitude and age of surface formation and surface maps are prepared. In some areas, sufficient information may be obtained to enable the geologist to recommend a drilling location without conducting additional exploration work.

Geochemical and Soil-gas Surveys - Geochemical and soil-gas surveys involve casual use of the land. In geochemical surveys, the chemical contents of water, soil, or vegetative samples are analyzed for the minute presence of oil or gas.

Gravity Surveys - Gravitational prospecting is a casual use to detect microvariations in gravity caused by the differences in the density of various rock types. The instrument used for gravity surveys is a small portable device called a gravimeter which can be carried by an individual. There is little surface disturbance associated with gravity prospecting except that which may be caused by off-road vehicle (ORV) use to transport equipment.

Geomagnetic Surveys - Magnetic prospecting is used to a limited extent in oil and gas exploration. Magnetic surveyors use an instrument called a magnetometer to detect small magnetic anomalies in the earth's crust. Most magnetic surveys are conducted from the air by suspending a magnetometer under an airplane. This is a casual use. There is no surface disturbance from magnetic survey operations.

3. Seismic Reflection Surveys (Geophysical Exploration)

Seismic prospecting is the most common indirect method used for locating subsurface structures which may contain oil and gas. Shock waves are induced into the earth using one of several methods. These

waves travel downward and outward encountering various strata, each having a different seismic velocity. Sensing devices called geophones are placed on the surface to detect these reflections. The geophones are connected to a data recorder which stores the data. The time required for the shock waves to travel from the seismic energy source down to a given reflector (a change in rock strata) and back to the geophone can be correlated to the depth of the reflector. At the present time, vibroseis and drilling/ explosive are the two most commonly used geophysical exploration methods.

Vibroseis Surveys - The thumper and vibrator methods pound or vibrate the earth to create the shock wave. Usually four large trucks, each equipped with vibrator pads (about 4-foot square), are used. The pads are lowered to the ground and vibrators on all trucks are turned on simultaneously. Information is recorded, the trucks are moved forward a short distance, and the process is repeated. Except where an access trail may be constructed or cross-country travel is necessary, surface disturbance is usually minimal since little surface area or disturbance is required to operate the equipment at each test site.

Drilling/Explosives - The drilling method utilizes truck-mounted drills which drill small-diameter holes to depths of 100 to 200 feet. Four to twelve holes are drilled per mile of line. Usually, a 50-pound charge of explosives is placed in the hole, covered, and detonated. The explosion sends energy waves which are reflected back to the surface from subsurface rock layers. The holes are drilled along a line that can be miles in length. In rugged topography, inaccessible to wheeled vehicles, a portable drill may be transported by helicopter. A typical drilling seismic operation may utilize 10 to 15 men operating 5 to 7 trucks. Under normal conditions, 3 to 5 miles of line can be surveyed each day using the explosive method. The vehicles used for a drilling program include several heavy truck-mounted drill rigs, water trucks, a computer recording truck, and several light pickups for the surveyors, shot hole crew, geophone crew, permit man, and party chief. Public roads and existing private roads and trails are used. Off-road, cross-country travel is also necessary. Activities in remote areas or difficult terrain may be supported by helicopters. Several trips a day are made along a seismograph line; this usually establishes a well defined two-track trail. Drilling water, when needed, is usually obtained locally.

Surface Charges - Another portable technique eliminates the drill holes by placing the charges on wooden sticks, or lath, 3 feet above the ground. Charges used are either 2- or 5 pounds. Usually, 10 charges in a line are detonated at once. In remote areas, a series of short seismic lines may be used to determine the regional dip and strike of subsurface formations. Seismic lines may then be aligned in relationship to the regional structures to facilitate more accurate seismic data and interpretations. The seismic sensors and energy source are located along lines on a 1- to 2-mile grid.

Primacord - Another seismic technique involves the use of explosive cord. The cord is buried in a 2-foot deep furrow, plowed by a specially designed mechanical plow mounted on a tractor. Multiple sets of cord, often in a pattern, are buried at the same time. This method offers efficiency advantages over the shot hole seismic method in that it is faster, less costly, and the quality of the data is often improved. However, surface disturbance may be considerably greater than with the shot hole seismic method.

4. Post-Lease Preliminary Investigations

If the preliminary investigations indicate that an oil or gas trap may exist in an area, the company may secure leases either directly through the Federal leasing system or from existing leaseholders through assignment (lease is purchased and ownership is assigned). Additional preliminary investigations may be carried out after a lease is acquired. Post-leasing investigations may include airborne and surface operations similar to those of the preleasing phase. The lessee may intensify the seismic studies by extending lines and laying out a criss-cross pattern of lines tying to the previous seismic lines. Other preliminary investigations may also be initiated prior to drilling.

B. EXPLORATORY DRILLING (PHASE 2)

1. Permitting Process

Proposed construction and other operations on NFS lands that involve surface disturbance conducted under the terms of a lease must be approved by the Forest Service before such activities are conducted. Activities on other public lands are approved by the BLM. Proposed drilling, development, and production operations must be approved by the BLM. Operations must be approved and conducted in accordance with (1) lease terms; (2) 43 CFR 3160; (3) 36 CFR 228, Subpart E; (4) Onshore Oil and Gas Order No. 1; (5) other onshore oil and gas orders; (6) applicable Notices to Lessees (NTL's); (7) conditions of approval; and (8) subsequent orders of the authorized officers of the Bureau of Land Management and Forest Service.

Where preliminary investigations are favorable and information warrants further exploration, exploratory drilling is conducted. More precise data on the geologic structure may be obtained by stratigraphic tests utilizing shallow holes. The presence of suspected oil and gas deposits may be confirmed by exploratory drilling of deep holes. Exploratory drilling on public lands, including NFS lands, is authorized only by a Federal oil and gas lease but cannot be conducted unless a surface use plan, drilling program, and Application for Permit to Drill (APD) are approved.

An APD includes a drilling plan which consists of (1) a surface use program, and (2) a drilling program. The detailed information required to be submitted under each program is identified in Onshore Oil and Gas Order No. 1 and 36 CFR 228, Subpart E and 43 CFR 3160. An onsite inspection of the proposed wellsite, road location, and other areas of proposed surface use is conducted prior to approval. For NFS lands, the Inspection Team includes Forest Service representatives, the lessee or his designated operator, the operator's principal drilling and construction contractors, an archeologist, and when necessary, a BLM representative. For other public lands, including split estate, the BLM representatives lead this Inspection Team. The purpose of the onsite inspection is to identify problems and potential environmental impacts associated with the proposal and the methods for mitigating those impacts. These may include making adjustments to the proposed wellsite and road locations, identifying the construction methods to be employed, and identifying reclamation standards for the lands after drilling.

The Forest Service is responsible for conducting the environmental analysis, preparing the documentation, and providing mitigation measures to protect surface resource values on NFS lands for APD approvals. The BLM is responsible for approval of the drilling program, protection of groundwater resources, and final approval of the APD.

Other proposals to occupy the surface that involve surface disturbance but are not associated with drilling a well must also receive advance approval under the procedures described above.

There are two options available to the oil and gas operator when applying for approval of an APD. These are (1) the Notice of Staking (NOS) option, and (2) the Application for Permit to Drill (APD) option.

NOS Option - Consists of an outline of what the company intends to do including a location map and sketched site plan. The NOS document is reviewed to identify any conflicts with known resource values, and also used for the onsite inspection and to provide the preliminary data to assess what items are needed to complete an acceptable surface use plan and drilling program.

Application for Permit to Drill (APD) Option - The operator or lessee may submit a completed APD, in lieu of the NOS, to the BLM. A field inspection is held by the BLM with the operator and the Forest Service. The drilling plan may be revised or site-specific mitigations are added as conditions of approval to the APD for protection of surface and/or subsurface resource values in the vicinity of the proposed activity.

Special-Use permits issued by the Forest Service are required for all facilities, tank batteries, pipelines, truck depots, powerlines, and access roads that occupy NFS lands outside the lease or unit boundary whether constructed by the lessee/operator or a third party.

2. Oil and Gas Exploratory Units

Surface use in an oil or gas prospect may be affected by unitization (consolidation) of the leaseholds. In areas of Federally owned minerals, an exploratory unit is formed before an exploratory well is drilled. The boundary of the unit is based on geologic data. The leaseholders of the unit can enter into an agreement to explore and/or develop and operate a unit, without regard to separate lease ownerships. Costs and benefits of the exploration are allocated according to agreed-upon terms. Unitization also has the potential to extend the term of a lease for at least two years.

3. Stratigraphic Tests

Stratigraphic test holes are drilled 100- to 500-feet deep to locate geologic indicators. The holes are usually drilled with truck-mounted equipment and disturb a relatively small area. Casing is needed for stratigraphic holes in areas of shallow high-pressure zones. The roads and trails constructed for access to the test sites are temporary and involve minimal construction. Only 1 to 3 days are required to drill each hole. A truck-mounted drilling rig is utilized. The drillsite occupies an area approximately 30 X 30 feet and is sometimes placed in the center of a new or existing trail.

4. Exploratory Oil and Gas Wells

Exploratory wells are deeper tests, require larger drilling rigs with support facilities, and may disturb a larger surface area than stratigraphic tests. Construction of access roads, drill pads, mudpits, and, in some cases, worker camps and helipads, are required to conduct exploratory drilling operations.

The wellsite is selected on the basis of prior surface investigations, seismic surveys, data from other wells that have been drilled in the area, topography, accessibility and requirements of lease stipulations and protection of surface resources.

a. Surface Requirements and Construction - Upon approval of the permit to drill, the construction equipment may enter the leasehold. The types of construction equipment used include dozers (track-mounted and rubber-tired), scrapers, and motor-graders. Moving equipment to the construction site requires several semitrucks.

Construction usually begins with the access road to the wellsite. Generally, the shortest feasible route consistent with the topography is selected to reduce the haul distance and construction costs. In some cases, potential environmental impacts or existing transportation plans dictate a longer route. In rough terrain, the type of construction is sidecasting where the material taken from the cut portion of the road is used to construct the fill portion. Roads are usually constructed to an 18-foot-wide running surface (in relatively level terrain). Road surfacing may be required because of adverse soil conditions, steepness of grade, and moisture conditions.

Wellsites are selected and constructed giving consideration to the amount of level surface required for safe assembly and operation of a drilling rig. The amount of area required varies with the drilling depth and the type of rig used and may vary between 2 and 5 acres in size. The substructure of the drilling derrick must be located on solid ground. Settling of uncompacted fill material under the drill rig has caused the substructure and mast to lean and even fall. In addition to the drilling platform, a reserve pit is constructed to accommodate spent drilling fluids and rock chippings resulting from drilling. The pit is usually square or oblong, but may be constructed in another shape to accommodate topography.

Wellsites are constructed using dozers, scrapers, and motorgraders. All soil material suitable for plant growth is first removed from areas to be disturbed and stockpiled in a designated area. Wellsites located on flat terrain usually require little more than removing the topsoil material and vegetation. Wellsites on ridge tops and hillsides are constructed by cutting and filling portions of the location to provide a level area (drill pad) to accommodate the drill rig, ancillary facilities, and drilling operations. The majority of the excess cut material is stockpiled in an area that will allow easy recovery for reclamation. Extra cut material

may need to be stockpiled to avoid casting the excess material down hillsides and drainages where it cannot be recovered for rehabilitation.

Depending on the relation of the drillsite to natural drainages, it may be necessary to construct water bars or diversions. The size of the area disturbed for construction and the potential for successful revegetation often depends on the steepness of the slope.

The drilling rig, and its attendant facilities such as pumps, mud tanks, generators, pipe racks, tool house, etc., are located on the drill pad. Other facilities such as storage tanks for water and fuel may be located on or near the drill pad. A typical wellsite location layout is shown in Figure 2.

Helicopter supported construction and drilling operations can be utilized in some instances. When this occurs, the need for constructing access routes is eliminated.

b. Drilling Operations - Usually drilling activities begin within a week or two after the wellsite and access road have been constructed. The drilling rig and associated equipment are moved to the site and erected. Moving a drilling rig requires 30 to 40 truckloads (some over legal weight, height, and width) of equipment over public highways and private roads.

The most commonly used well drilling equipment is the rotary rig which consists of (1) a power system, normally diesel engine powered electric generators; (2) a hoisting system which consists of a derrick ("mast"), crown block and traveling block used to lift and lower the drill; and (3) the rotary system which consists of the drill bit attached to a length of tubular high tensile steel "drill stem pipe" (collectively called the "drill string") which is turned by a rotary table; and (4) the mud circulating system consisting of mud tanks, mud pumps, and reserve pit.

Depending on the height of the substructures, the mast may rise to over 160 feet above the ground surface and is the most visible and noticeable feature of a drill rig. The start of drilling is commonly referred to as "spudding." The actual drilling is accomplished by passing the drill string through the rotary table which turns the drill string and bit which in turn performs the actual drilling. The weight of the drill string provides downward pressure on the drill bit which chips and pulverizes the rock as it rotates in the bottom of the hole. By continually adding more drill stem pipe to the drill string, the hole is steadily deepened.

A short piece of tubing called a conductor pipe is placed into the ground and cemented in place. The conductor pipe keeps the surface soil from sloughing into the well bore. Next, the regular drill bit and drill string are placed inside the conductor and drill the well begins.

Once the hole reaches a depth of several hundred feet, surface-casing is set and cemented in the hole by pumping cement between the casing and the hole wall. Surface-casing acts as a safety device to protect fresh water zones from drilling fluid contamination to prevent the well from "blowing-out" in the event the drill bit hits a high pressure zone, blowout preventers are mounted on top of the surface-casing. If high pressure zones are encountered that cannot be controlled with mud additives, the blowout preventers can be closed to effectively seal the well.

Blowouts are extremely dangerous and may result in uncontrolled fire, escape of toxic gases, loss of lives, extensive environmental damage, and loss of resources and equipment. It is usually very difficult and expensive to bring a well back under control. Blowout prevention equipment is tested and inspected by both the rig personnel and the BLM. The drill rig crew must be trained in safety and blowout prevention.

After the surface-casing is set, a smaller drill bit that fits inside the surface-casing, is installed and drilling resumes. Depending on well conditions, additional strings of casing called intermediate-casing may be installed and cemented into place. Conditions resulting in the need for intermediate-casing include freshwater zones and sloughing formation zones. Casing prevents the flow of fresh water into the well bore and, conversely, prevents drilling fluids from infiltrating porous formations with low internal pressures. Casing also prevents mixing of waters from different formations (interformational mixing) where water within the formations are of differing quality.

All cementing operation plans are reviewed to assure that cement is placed at the appropriate depths and sufficient quantity is utilized to effectively seal all fresh water-bearing formations from contamination by interformational mixing or migration of fluids.

Drilling mud (fluid) is circulated through the drill pipe and bit to the bottom of the hole, then up the bore of the well, through a screen which separates the rock chips, and into holding tanks from which it is pumped back into the well. The mud is maintained at a specific weight and thickness to cool the drill bit, lubricate the drill string, seal porous rock zones, prevent blowout or loss of drilling fluid, and transport the rock chips resulting from the drilling to the surface for disposal. Various additives are used to maintain the drill mud at the desired viscosities and weights. Some additives that may be used are caustic, toxic, or acidic. The spent drilling mud and rock chips are disposed of in the reserve pit.

Water for drilling is hauled by truck to the rig storage tanks or transported by surface pipeline. Water sources are usually rivers, wells, or reservoirs. Occasionally, water supply wells are drilled on or close to the drillsite. The operator must obtain a permit from the State for the use of surface or subsurface water for drilling. When the Forest Service holds the water permits for surface water (stock ponds), it must also approve such use. Water is continually being transported to the wellsite during drilling operations. Although it will vary significantly from well to well, approximately 40,000 barrels or up to 1,700,000 gallons of water may be required to drill an oil or gas well to the depth of 9,000 feet. If water is hauled by truck, a significant amount of traffic to and from the drillsite will be generated by water hauling. More water is required if the underground rocks are fractured and drilling fluids are lost into the formation (lost circulation zone). Uncontrollable loss of drilling fluids may cause drilling to be terminated.

As the drilling proceeds, additional casings of concentrically smaller diameter are lowered into the well and sealed in place until the final depth (the "target zone") is reached. During the drilling process, the drill string must be pulled from the well periodically to change the drill bit, install casing, or remove core samples from the wellbore. Core samples are analyzed to determine the type of rocks penetrated and their porosity, permeability, chemical properties, and hydrocarbon content.

Drilling operations continue 24 hours a day and 7 days a week. The crews usually work three 8-hour shifts or two 12-hour shifts a day. The greatest amount of human, vehicular, and equipment activity and accompanying noise, etc., occurs during construction and drilling activities. A significant amount of traffic is generated by trucks hauling equipment and water, service companies delivering supplies and equipment and performing specialized work on the drill, drilling crew shift changes, well treatment and testing equipment, etc. There is a high level of human activity and use of heavy construction and drilling equipment during drilling operations which is accompanied by considerable noise and highly visible activity.

Upon completion of the drilling, the well is "logged" and tested to obtain information about the rock formation and production of fluids. After completion of the tests the drill rig and other equipment are removed. If oil or gas is not discovered in commercial quantities, the well is considered dry. The operator must comply with state and Federal procedures for plugging a dry hole.

FIGURE 2

WELLSITE LOCATION LAYOUT

1. Crown
2. Mast
3. Catline Boom
4. Racking Platform
5. Drill Line
6. Traveling Block
7. Hook
8. Swivel
9. Rotary Hose
10. Standpipe
11. Drawworks
12. Drillers Console
13. Pipe Setback
14. Drill Floor
15. Rotary Table
16. Substructure
17. Blow Out Preventor Stack
18. Dog House
19. Choke Manifold
20. Gas Flare
21. Mud Gas Separator
22. Shale Shaker
23. Degasser
24. Desander
25. Mud Cleaner
26. Mud Guns (Bottom Type)
27. Mud Agitators
28. Mud Tanks (3)
29. Mud Sack Storage
30. Mud Mixing Hopper
31. Mud Mixing Pumps
32. Mud Pumps (2)
33. Pulsation Dampeners
34. Shock Hoses
35. Mud Discharge Lines
36. Brake Water Tank
37. Mud Lab
38. Trip Tank
39. Mud Return Line
40. Drilling Water Tank
41. S.C.R. House
42. Cable Tray
43. Cable Elevator
44. Engines and Generators
45. Engines and Air Compressors
46. Parts Storage
47. B.O.P. Closing Unit
48. Work Shop
49. Pump Parts Storage
50. Fuel Tank
51. Junk Bin
52. Personnel Elevator
53. Wire Line Stand
54. Stairway With Pipe Ramp
55. Catwalks
56. Drill Pipe
57. Pipe Rack
58. Auxiliary Brake

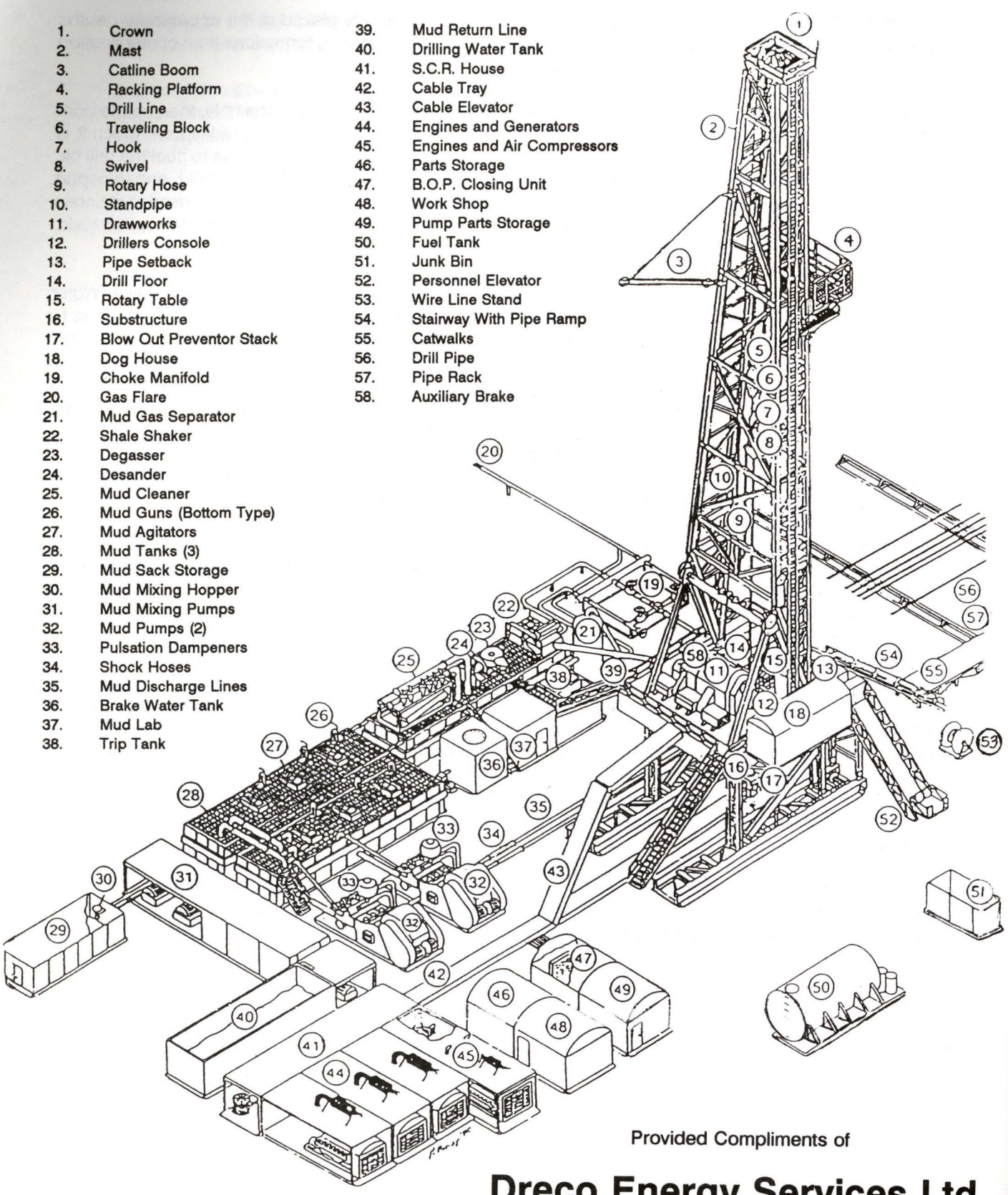
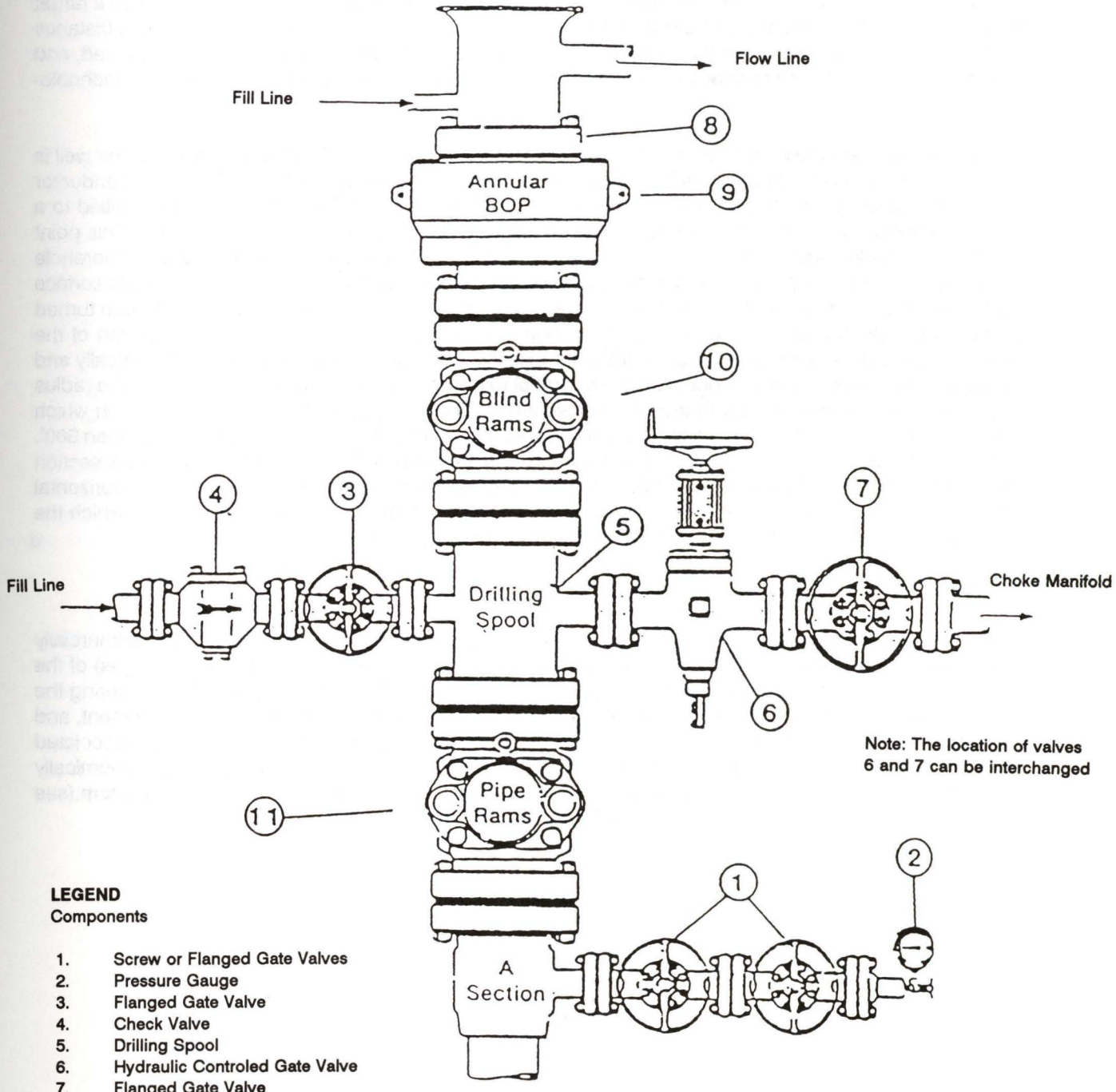


FIGURE 3

BLOW OUT PREVENTER

THREE PREVENTER STACK



LEGEND
Components

1. Screw or Flanged Gate Valves
2. Pressure Gauge
3. Flanged Gate Valve
4. Check Valve
5. Drilling Spool
6. Hydraulic Controled Gate Valve
7. Flanged Gate Valve
8. Annular BOP Ring Gasket
9. Annular BOP
10. Blind Rams
11. Pipe Rams

SOURCE: BLM, 1988

5. Directional Drilling

Directional drilling may be used where the drillsite cannot be placed directly over the reservoir, as might be the case where a river or mountain is involved, where no surface occupancy is permitted on the leasehold, or where land use restrictions require centrally located drillsites. (See Figure 4a).

There are limits both to (1) the degree that the well bore can be deviated from the vertical and, (2) the horizontal distance the well can be drilled from the wellsite to the target zone. As a rule of thumb, it is not possible to drill directionally from outside an area where surface occupancy is denied and reach a target zone at a horizontal distance of more than 1/2 to 1 mile from the drillsite. The limit of horizontal distance is also affected by depth of the target zone, characteristics of the rock formation to be penetrated, and the additional costs of directional drilling. These factors are all considered before applying this technology.

Horizontal wells are drilled similar to directional wells except that the bottomhole location of the well is not a single point (see Figure 4b). A horizontal well is started like a conventional vertical well. Conductor and surface casing are set and cemented in place and BOPs are installed. The well is then drilled to a pre-determined point where the hole angle will be diverted from the vertical or straight down. This point is known as the kick-off point. It is at this point that complex drilling tools are used to veer the borehole off the vertical and turn the well to the horizontal plane. These tools also provide information to the surface on the direction and inclination of the borehole (azimuth and angle). Once the borehole has been turned to the horizontal, the well continues along the horizontal plane until the total permitted length of the horizontal section is reached. Horizontal wells are classified or typed by the distance (both vertically and horizontally) it takes to turn the borehole from vertical to horizontal. This distance is known as the radius or curvature of the well and there are three basic types. The first type is the short radius well in which the borehole is turned from vertical to horizontal in less than 100' and horizontal section is less than 500'. The second type is the medium radius in which the well is turned in 500' - 1000' and the horizontal section can reach a distance of greater than 1000' and the horizontal distance can exceed 4000'. Most horizontal wells within the project area are medium radius wells. The third type is the maximum radius in which the well needs more than 1,000 feet to attain the horizontal drilling plane.

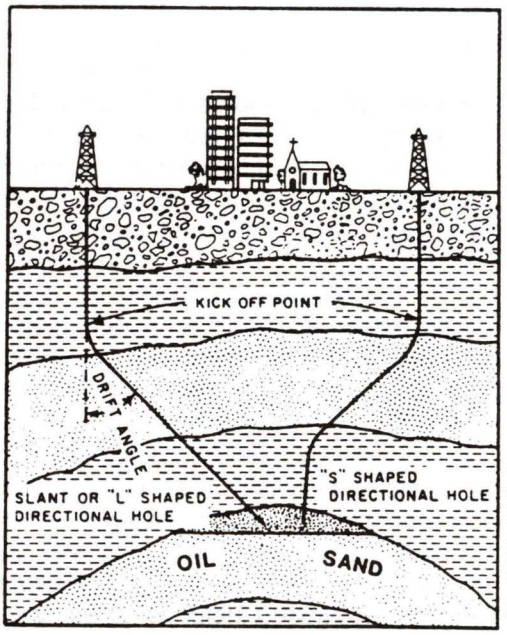
6. Oil and Gas Discovery

At the completion of drilling, the well is evaluated to determine if hydrocarbons can be commercially produced. A "drill stem test" is conducted to directly measure the fluid content (water, oil, or gas) of the formation and the amount of flow and shut-in pressure of the well. The well is "logged" by measuring the electric resistivity which provides information as to the porosity of the rock, the kind of fluids present, and fluid saturation level of the rocks. These physical characteristics of the rock formations and associated fluids are measured and recorded. If it is determined, based on the tests, that the well can be economically developed for production, the well is readied for production, and connected to a gathering system (see Field Development (Phase 3)(p. C-17) and Production (Phase 4)(p. C-22)).

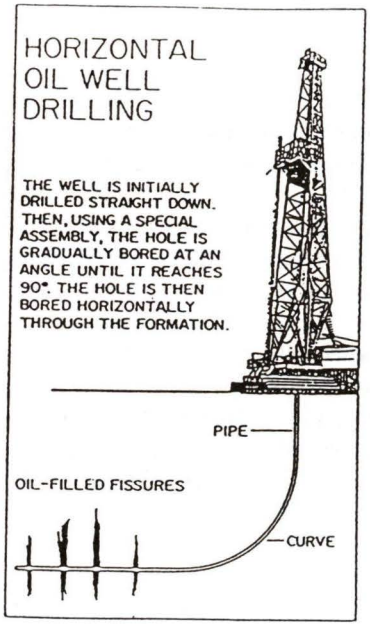
FIGURE 4

a.

DIRECTIONAL DRILLING



b.



Source: Courtesy of PETROLEUM INFORMATION

C. FIELD DEVELOPMENT (PHASE 3)

The completion of an exploratory oil and gas well as a commercial producer marks the beginning of the development of an oil and gas field.

1. Approval of Field Development Plans

After discovery of oil and gas and prior to the development of a field, the lessee/operator must receive approval of the Applications for Permits to Drill (APD's) and the Drilling and Surface Use programs that make up the Drilling plans. A Field Development Plan consists of a coordinated collection of site-specific drilling and surface use proposals for individual wells as required by Onshore Oil and Gas Order No. 1. The lessee/operator should submit the plan when sufficient information is available to project a reasonably foreseeable development of the field. Sufficient information may not be available until one or more confirmation wells have been drilled to delineate the characteristics of the reservoir. The limits of a field located on a structural trap can be determined more easily than a stratigraphic field based on the information obtained from drilled wells and geophysical data. The proposed field development is subject to environmental analysis prior to approval or rejection of the APD.

The Drilling Plan includes information on existing roads, the proposed location of the access roads, the proposed and existing wells, and the tank battery, camps, and airstrips; the proposed location and type of water supply; the proposed waste disposal methods; plans for reclamation of the surface; and other information deemed necessary.

The geological information required to be submitted includes (a) occurrence and anticipated depths of fresh water aquifers, (b) expected depths of possible oil or gas productive zones above or below the zone already discovered, (c) other mineral bearing formations, (d) the potential for entering highly permeable formations in which the drilling mud might be lost, (e) the anticipated pressures in the formations to be drilled, and (f) the potential for encountering other geologic conditions which could cause drilling problems. This information is obtained to determine whether the proposed drilling program is adequate, and to insure the drilling mud, pressure control, casing, cementing, testing, well logging, and completion programs adequately protect the surface and subsurface environments, protect other subsurface resources, and provide safe working conditions.

2. Well Spacing Pattern

Before development of an oil and gas field begins a well spacing pattern is established to allot a spacing unit for each well that will be drilled in the discovery area. Oil well spacing patterns in the United States normally range from 2 acres per well to 640 acres per well. Spacing units established for oil production are usually closer than gas well spacings and are generally in multiples of 40 (40, 80, 160, 320, 640 acres per well). Gas well spacing patterns in the United States range from 40 to 1440 acres per well. Most spacing patterns established at the present time for production of gas are 160, 320, or 640 acres per well.

The well spacing pattern established for an oil and gas field is the primary factor that determines the amount and intensity of human presence and associated activity during the development and operation of an oil and gas field and the amount of surface disturbance and land area required to accommodate surface facilities. The wider the well spacing pattern, the lower the intensity and concentration of human activity and the less overall surface disturbance occurs within the oil and gas field.

3. Unitization

Surface use in an oil and gas field is affected by unitization (consolidation of leases) of the leaseholds. In areas involving Federal lands an exploratory unit is formed pursuant to 43 CFR Subpart 3180 through Subpart 3186. The area enclosed within an exploratory unit is based on available geologic data.

A unit agreement provides for (a) development and operation of the field as a single, consolidated unit without regard to separate lease ownerships; and (b) the allocation of costs and benefits according to

terms of the agreement. "Exploratory Units" are also formed to share the cost of drilling exploratory wells to test geologic structures. Unit agreements involving Federal leases require BLM approval.

Field development under a unit agreement reduces the surface use requirements because all wells within the unit boundaries are operated as though they are located on a single lease. Development and operations of the field are planned and conducted by a single unit operator and, therefore, duplication of field processing equipment and facilities is minimized. Oil or gas field development under a unitization plan may also involve a wider well spacing pattern and fewer wells than a field developed on a lease by lease basis.

In accordance with unitization provisions, if drilling is commenced prior to the end of the primary term of any lease committed to the unit, then that lease's term may be extended for two years; and so long thereafter as oil or gas is produced in paying quantities. A lease would only receive the benefit of a 2-year extension if there is drilling within the unit **over the extension date** of the lease(s). If the obligation well was drilled and completed as a dry hole prior to the expiration date of the lease, it would expire under its own terms.

4. Drilling Procedures

The drilling of development wells is essentially the same as the drilling of an exploratory oil and gas well. Roads and other facilities are planned and constructed for long term use.

5. Surface Use Requirements

Surface uses associated with oil and gas field development wells include access roads, wellsites, flowlines, storage tank batteries, and facilities to separate oil, gas, and water. In remote locations, worker camps may be required. Access roads are planned, located, and constructed for long term use as opposed to roads built for short term use to drill exploratory oil and gas wells.

6. Surface Use and Construction Standards

The minimum standards for design, construction, and oil and gas operations are set forth in the "Surface Operating Standards for Oil and Gas Exploration and Development, Third Edition - U. S. Forest Service and Bureau of Land Management". The publication prescribes the minimum operating standards for oil and gas operations on Federal lands. The objective of the standards is to minimize surface disturbance, effects on other resources and retain the reclamation potential of the disturbed area. Additional site-specific construction and design standards may be required depending on the proposed activities and conditions encountered at the construction site.

The locations for wellsites, tank batteries, mudpits, pumping stations, roads, and pipelines are selected to minimize to the extent possible the long term impacts to other resources and disruption of other land uses. Ideal locations for oil and gas activities are seldom available and avoidance of damage to surface resources is not always possible. Wellsites are constrained by the geologic target to be drilled and pipelines, because of their linear nature, cannot always be located to avoid all areas exhibiting environmental sensitivity to impacts. In the selection of sites special attention is given to avoiding construction on steep topography and unstable soils, near streams and other open water areas, on cultural resource sites, and in threatened, endangered, or sensitive species habitats. It is not possible or practical to avoid all situations and special construction techniques may need to be employed to minimize the impacts.

Wellsites are usually located on the most level location available that accommodates the intended use consistent with reaching the geologic target. The drillsite layout can also be oriented to conform to or fit into the topographic conditions at the drillsite. However, safety considerations in a hydrogen sulfide (H_2S) area may be an overruling factor when determining the topographic setting and providing adequate escape routes for the drill crew. Onshore Oil and Gas Order No. 6 sets forth hydrogen sulfide gas regulating considerations and requirements. (43 CFR 3160). In general, steeply sloping locations which require deep nearly vertical cuts and steep fill slopes are avoided or appropriately mitigated. The wellsite

is also reviewed to determine its effect in conjunction with the location of the access road. Advantages gained on a good wellsite or tank battery location may be negated by adverse effects from the location of the access road.

Wellsite Construction Standards - Construction of the wellsite must conform to the approved wellsite and layout plan in the Surface Use Plan of Operations and excavation of the cut and fill slopes of the wellsite are guided by information on the surveyed construction stakes. Generally all surface soil materials ("topsoil") are removed from the entire construction area and stockpiled. The depth of topsoil to be removed and stockpiled is determined at the predrill inspection and stated either in the proposed surface use plan of operations or specified as a condition of approval. In order to avoid mixing topsoil with subsurface materials during construction and reclamation topsoil stockpiles are located at specified locations, out of the way of construction activities.

Fill materials are to be compacted to minimize the chance of slope failure. Terracing may be used on both cut and fill slopes to reduce the land area occupied by the wellsite, to prevent excessive water accumulation, slope failure, and erosion. If excess material needs to be excavated, the excess material is to be disposed of or stockpiled at approved locations. Snow and frozen soil material cannot be used in the construction of fill areas and a reserve pit.

The area of the well pad that actually supports the drilling rig substructure must be level and capable of supporting the weight of the rig. The drilling rig, tanks, heater-treater, etc., are not placed on uncompacted fill material. The area used for mud tanks, generators, mud storage, and fuel tanks, etc., is usually slightly sloping to provide surface drainage from the work area. Runoff water from off site areas is diverted away from the wellsite by ditches, waterbars, or terraces up-slope from the drilling and wellsite.

The reserve pit is to be located and constructed entirely in cut material. If this is not possible, at least 50 percent of the reserve pit must be constructed below original ground level to prevent failure of the pit dike. Pit dikes constructed of fill material are to be adequately compacted.

Pits improperly constructed on slopes may leak along the plane between the natural ground level and the fill. There is a significant potential for pit failure in these situations.

It may be required to line reserve pits to prevent contamination of ground water and soil. Bentonite, plastic, or other synthetic liners may be required to be used. Fencing of reserve pits is usually required to prevent access to wildlife or livestock. In some environmentally sensitive areas or where topography limits the size of the wellsite, a "self-contained mud system" may be required. The drilling fluids, mud, and cuttings are stored in metal tanks and transported to approved offsite disposal areas.

A closed mud system and safety "surge tank" may be used in lieu of a reserve pit at locations such as areas with limited space in which to locate a drillpad, high water table area, or other situations where a reserve pit cannot be accommodated. The surge tank is used to contain the spent downhole fluids, muds, and cuttings from the wellbore. Since there is no reserve pit in which to dispose of the cuttings and spent drilling fluids they must be periodically trucked from the drillsite during the drilling of the well and disposed of at an approved location. The removal and disposal of the wellbore cuttings and spent drilling fluids is very expensive and closed mud systems, although not infrequently used, are not employed as a standard drilling practice.

Roads and Access Ways - It is Forest Service policy that existing roads be used for access when they are available, when they meet Forest Service standards for the intended use, and when there are no significant conflicts with other uses. When access involves use of existing agency roads, the oil and gas operator may be required to contribute to the road's maintenance. Usually this use is authorized by a joint use agreement in which each user's pro rata share of the road maintenance costs are assessed.

New road construction, or reconstruction, by the operator is consistent with the goals of the Forest's transportation plan and must meet Forest Service standards established for the intended road use.

Proper road location is critical for the engineering success and mitigation of the environmental effects of road construction. The surface and subsurface conditions of a proposed road location also determine the cost to survey, design, construct, and maintain a road. The following factors are considered when determining road locations: (1) the intended use of the road, planned season of use, and type of vehicles to be used; (2) the Forest's transportation plan which may already identify feasible routes for the area; and (3) existing data, including maps and aerial photos, of administrative, biological, physical, and cultural conditions of the area.

A field reconnaissance during the predrill inspection of the proposed and alternative routes is made to determine type of excavation, landslide areas, and subgrade conditions, indicating the need for surfacing, potential cut slope problems, surface or subsurface water problem areas, suitability of fill material, potential gravel pits or quarries for road aggregate, and potential borrow and waste sites.

When steep slope areas, erosion hazard areas, visual resource areas, stream crossings, and other areas of high environmental sensitivity cannot be avoided, special road design, and construction techniques may be required.

Both the BLM and the Forest Service require that all permanent roads constructed by nongovernment entities across public or NFS lands be designed by, or constructed under the direction of, a licensed professional engineer. The design and construction requirements depend on the site conditions, planned use of the road, seasons of use, amount and type of traffic, and whether use will be short- or long-term. These factors are also used to determine the class of road built to accommodate the intended use(s).

The specific design specifications and requirements depend on whether the road class is (1) short term, (2) local, (3) collector; or (4) arterial road. Each road class is based on a transportation need and must meet certain design criteria. Other factors, unique and directly applicable to the oil and gas industry, considered include:

- The prevailing wind direction in relation to the potential for encountering sour gas (H_2S) and the need for a clear escape route from the drillsite.

- The potential for year round operation: drillsites and producing locations may require all-weather access and special maintenance considerations for snow removal.

- The potential for exploratory drilling to result in a producing operation. The initial road alignments will be such as to allow upgrading to a permanent road if a discovery is made.

When the road location information is submitted to the Forest Service in the surface use plan, the proposed route, and if applicable, alternative routes, road design standards and construction methods, are evaluated. Final approval of the road location, road design standards, and construction standards are made during processing of the surface use plan.

Pipelines Standards - General pipeline construction standards were established to minimize surface disturbance, provide soil stability, and preserve reclamation potential. Pipeline construction usually involves clearing vegetation and leveling a strip of land wide enough to accommodate a pipeline trench, excavated material, and pipeline construction equipment and transport trucks. The width of the area cleared and leveled is kept to a minimum consistent with access and construction requirements. The width of the disturbed area varies depending on the number of lines within a corridor, size of the pipeline, equipment, and topographic setting.

Locating pipeline routes on steep hillsides and adjacent to live watercourses is avoided to the extent possible. However, because of the extended linear nature of a pipeline these situations cannot be entirely avoided. Extensive cuts and fills that destabilize steep slopes are major problems with sidehill locations. Pipelines located adjacent to watercourses increase the risk of petroleum spills and silt from construction sites entering streams.

Pipeline beds are constructed so they do not block, dam, or change the natural watercourse of any drainage. Pipelines suspended above watercourses must provide adequate clearance for water runoff and waterborne debris, and allow for the passage of wildlife and livestock. Pipelines located on gentle topography usually require less construction and surface disturbance, and are, therefore, inherently more stable and retain greater reclamation potential.

It is a standard practice to stockpile topsoil to the side of the pipeline right-of-way prior to construction and leveling the pipeline bed. The topsoil is segregated and not mixed or covered by excavated material during construction.

Upon completion of construction, the pipeline is graded to conform to the adjoining terrain, the surface soil material returned to the right-of-way, and the pipeline right-of-way waterbarred and revegetated to avoid erosion and minimize the visual intrusion.

7. Oil Field Production Development

Production operations in an oil field begins soon after the discovery well is completed. Portable and temporary facilities located on the drillpad are used to initiate the production of oil from the reservoir. As further drilling proceeds and reservoir limits are established, permanent production facilities are designed and installed at centralized locations. The type, size, and number of the facilities are determined by the number of producing wells, expected production rates, volumes of gas and water expected to be produced with the oil, the number of separate leases involved, and whether or not the field is being developed on a unitized or individual lease basis. Development of production on a lease basis requires handling and processing facilities be installed on or near each lease. Unitization reduces the number of facilities needed to produce, process, and store the oil prior to marketing.

8. Gas Field Production Development

Production operations in a gas field begins when a pipeline to a market outlet is constructed. Market pipelines are not economical unless sufficient gas reserves have been proven to exist by drilling operations. Gas wells are often shut-in after completion for periods of several months or years until a pipeline connection becomes available.

9. Rate of Development

The rate at which development wells are drilled in a newly discovered field depends upon (a) whether the field is developed on a lease basis or unitized basis, (b) the probability of profitable production, (c) the availability of drilling equipment, (d) protective drilling requirements, and (e) the degree to which limits of the field are known. The development of a field that is based on a stratigraphic reservoir may proceed more slowly and yield more dry holes than development of a field located on a structural trap reservoir.

The most important factor when determining how fast field development is undertaken is indicated production potential. If large productive capacity and substantial reserves are indicated, development drilling proceeds at a rapid pace. If there is a question as to whether indicated reserves are sufficient to warrant additional wells, the development drilling occurs at a slower pace. An evaluation period to observe production performance may follow between the drilling of each well.

Development on an individual lease basis proceeds more rapidly than development in a unitized area. When development drilling is undertaken on a lease basis, each lessee drills his own well(s) to obtain production from the field. This creates a competitive situation where the first wells drilled produce the greatest share of oil from the reservoir and quickest and greatest return on investment. When unitized, all owners within the "participating area" share in a well's production regardless of whose lease the well is located on. The development of a reservoir can then proceed in an orderly manner and pace.

10. Protective Drilling

The drilling of a well to prevent drainage of petroleum to a producing well on an adjoining lease may be required in fields which contain a mixture of Federal lands and patented or fee lands. The terms of Federal leases require the drilling of a protective well on the leased tract if an "offset" well is located on adjacent non-Federal lands or on Federal lands leased at a lower royalty rate. An "offset" well is a well drilled at the next location in accordance with the established spacing rule to prevent the drainage of oil and gas to an adjoining tract where a well is being drilled or is already producing.

11. Pool Discoveries

Discovery of a "new pay zone" within an existing field is a "pool" discovery, as distinguished from a new field discovery. A pool discovery results in the drilling of additional wells - often on the same well pads as existing wells, or often sharing the same boreholes or separated only by a few feet. Existing wells may also be drilled deeper to the new pay zone. Each new pay zone developed requires additional flowlines, storage, and treatment facilities if the fluids from the various pools are to be kept separate. Some fields contain as many as seven, or more, pay zones all sharing a geologic structure that created the conditions for the accumulation of oil and gas.

D. PRODUCTION (PHASE 4)

Production is a combination of operations that includes: (1) bringing the fluids (oil, gas, and water) to the surface; (2) maintaining and/or enhancing the productive capacity of the wells; (3) treating and separating the fluids; (4) purifying, testing, measuring, and otherwise preparing the fluids for market; (5) disposing of produced water; and (6) transporting oil and gas to market.

The production of oil and gas from a single well is usually initiated as soon as drilling is completed and the well is developed for production. In the meantime, other wells may be in production, being drilled, or exist only in the field development plans. There is also usually little time separation between the activities associated with exploratory drilling, oil and gas field development, and actual production of oil or gas. It may take a few months to several years before a field is fully developed. Therefore, field development activities and those activities normally associated with oil and gas production occur simultaneously during the early life of a field. Drilling of new wells is undertaken periodically throughout the life of a producing field to increase or maintain production from the reservoir.

1. Well Completion Report

A "Well Completion or Recompletion Report and Log" must be filed with the BLM within 30 days after completion of a well for production. The completion report reflects the mechanical and physical condition of the well. Geologic information and, when applicable, information on the completed interval and production is required. Operators must notify the BLM no later than the 5th business day after a well begins production.

Horizontal wells are normally completed with steel casing that is installed from the surface through the entire length of the horizontal section. The section of casing in the horizontal portion of the hole already has holes or perforations. Several special tools are installed between the perforated casing and the solid casing to isolate the producing formation from other important and valuable zones above, i.e., other potential producing zones, disposal zones and fresh water aquifers. One of these tools is an inflatable casing packer. This tool does not allow downward movement of fluid in the borehole annulus during cementing operations. Above the packer is a cementing tool which allows fluid (cement) to be diverted from inside the casing to the outside of the casing. With the packer in place and the cementing tool, cement can be circulated or placed in the angle section of the hole and up into the vertical section of the hole. By using a combination of cement tools and other techniques, cementing of casing in horizontal wells provides similar protection as in vertical wells. In some cases, the casing does not have pre-drilled holes for the horizontal section and is completed in a fashion similar to vertical wells, except that the cementing is accomplished in stages to ensure adequate zone isolation.

2. Well Completions

After a well has been drilled and evaluated for its economic worth and profit, work to set the casing and prepare the well for completion and production begins. The decision to complete an individual well for production is based on the type of oil or gas accumulations involved, the expected future development that may be undertaken during the life of the well, and the economic circumstances at the time that the work is done. Completion equipment and the methods employed varies.

Well completion involves installation of steel casing between the surface casing and the oil and gas producing zone. The casing is cemented between the wellbore and casing wall to provide stability and to protect specific zones, i.e., fresh water aquifers. The casing is perforated opposite the "pay zone" and the "pay zone" may then be "stimulated" or "treated" to increase productivity.

The drilling rig and most of the support equipment are moved from the wellsite after the casing is cemented and the pay zone is stimulated. Small diameter "production" tubing is then placed inside the casing down to the producing zone. The tubing is connected to the surface equipment and transports the oil and gas from the bottom of the well to the surface. If the pressure is sufficient to raise a column of oil to the surface the well is completed as a flowing well. When pressure is not sufficient, a pumping system is installed. After the well is completed, the well is tested for a period of days or months before another well is drilled.

Temporary storage tanks are normally used to hold the produced oil during testing. A "separator" is required to separate the gas from the oil. The gas separated from the oil may be burned off as waste until a pipeline connection is available. If water is produced with the oil, a "treater" is needed to separate emulsified oil and water.

3. Well Stimulation

"Well stimulation" is employed to enlarge channels or to create new ones in the producing formation rock to enhance oil and gas production. Since oil is usually contained in the pores or cracks of sand or limestone formations, enlarging or creating new channels allows the oil or gas to accumulate and move more freely to a wellbore. A well may be restimulated several times during its lifetime to maintain or increase production. There is a short term increase in activity at the wellsite during this process. Generally no new surface disturbance is required to perform these operations. Three basic well stimulation methods have been developed: explosive fracturing, acid treatment, and hydraulic fracturing.

Explosive fracturing is used to enlarge the wellbore, eliminate nearby plugging of the rock pores, and force fluids into the formation, thereby fracturing the rock in the proximity of the well bore to stimulate increased production.

Acid treatment dissolves rock with weak hydrochloric acid, thereby enlarging existing channels and opening new ones for oil to flow to the wellbore. Reservoir rocks most commonly acidized are limestone (calcium carbonate) and dolomite that exhibit low permeability. Well servicing rigs are used to prepare both new and old wells for acid treatment.

Hydraulic fracturing is used to create or enlarge cracks in sandstone reservoirs in the same manner as acid treatment is used in limestone or dolomite reservoirs. Hydraulic pressure is applied against the formation by pumping fluid, usually diesel fuel, under high pressure into the well. This pressure splits and cracks the rocks to improve the productivity of the well, or increase the rate fluids can be injected into disposal wells. Most well pads are of sufficient size to accommodate the trucks and other equipment needed to complete a "frac" job, however, a second pad and additional surface disturbance may be required for safety considerations and to accommodate the large amount of equipment needed to perform special "massive fracture" jobs.

4. Oil Wells - Wellhead Facilities

The "wellhead" is the equipment installed to maintain control of the well at the surface and to prevent well fluids from "blowing" or "leaking" at the surface. The pressures encountered in the well determine the type of wellhead equipment needed. This varies from a simple assembly to support the weight of the production tubing in the well to a high-pressure wellhead to control reservoir pressures. Pressures in these reservoirs are usually great enough to result in a "flowing" well. However, after reservoir pressures are depleted, some type of artificial lift is usually required to bring the oil to the surface.

a. Flowing Wells - The surface equipment at the head of a flowing well is limited to a series of valves, or "Christmas tree," and a fenced service area ranging from 15 by 15 feet to 50 by 50 feet around the wellhead. (See Figure 5). A service area may also contain a small (1 by 2 by 3 feet) gas powered chemical pump and "guy line" anchors for servicing units brought in for well repairs. Chemical pumps used to inject emulsion breakers, corrosion inhibitors, or paraffin solvents into the well or flowline may be present.

b. Artificial Lifts (Pumping) - When a well is completed, the natural reservoir pressure drives the fluid to the surface. At some time during the life of an oil well, the pressure is depleted and some form of artificial lift is used to raise the fluid to the surface. The most common methods of artificial lift are sucker rod pumps, centrifugal pumps, hydraulic pumps, and gas lift. All of the pump systems require some type of surface equipment and a power system. All power systems generate noise, however, this ranges from almost none for electric motors to high noise levels for single cylinder gas engines.

Sucker Rod Pumps - The pumping unit is the most visible and recognizable piece of equipment within oil fields. Pumping units vary in size from 4' to over 25' in height depending on depth of well. (See Figure 6). The principle of the sucker rod pump is the same as that of the common hand pump used to lift water. A series of rods and a valve move up and down through a "stuffing box" in the well to bring the oil to the surface. The stuffing box is regularly maintained to prevent oil leaks from the wellhead. Failed packing in stuffing boxes is a common cause of oil spills. The rod is connected to a reciprocating pumping unit or pump jack. Surface pumping units are usually powered by electric motors, however, internal combustion engines are used when electric power is not available. Single-cylinder engines operate at very high noise levels, whereas multi-cylinder engines operate at lower noise levels and electric motors at a very low noise level.

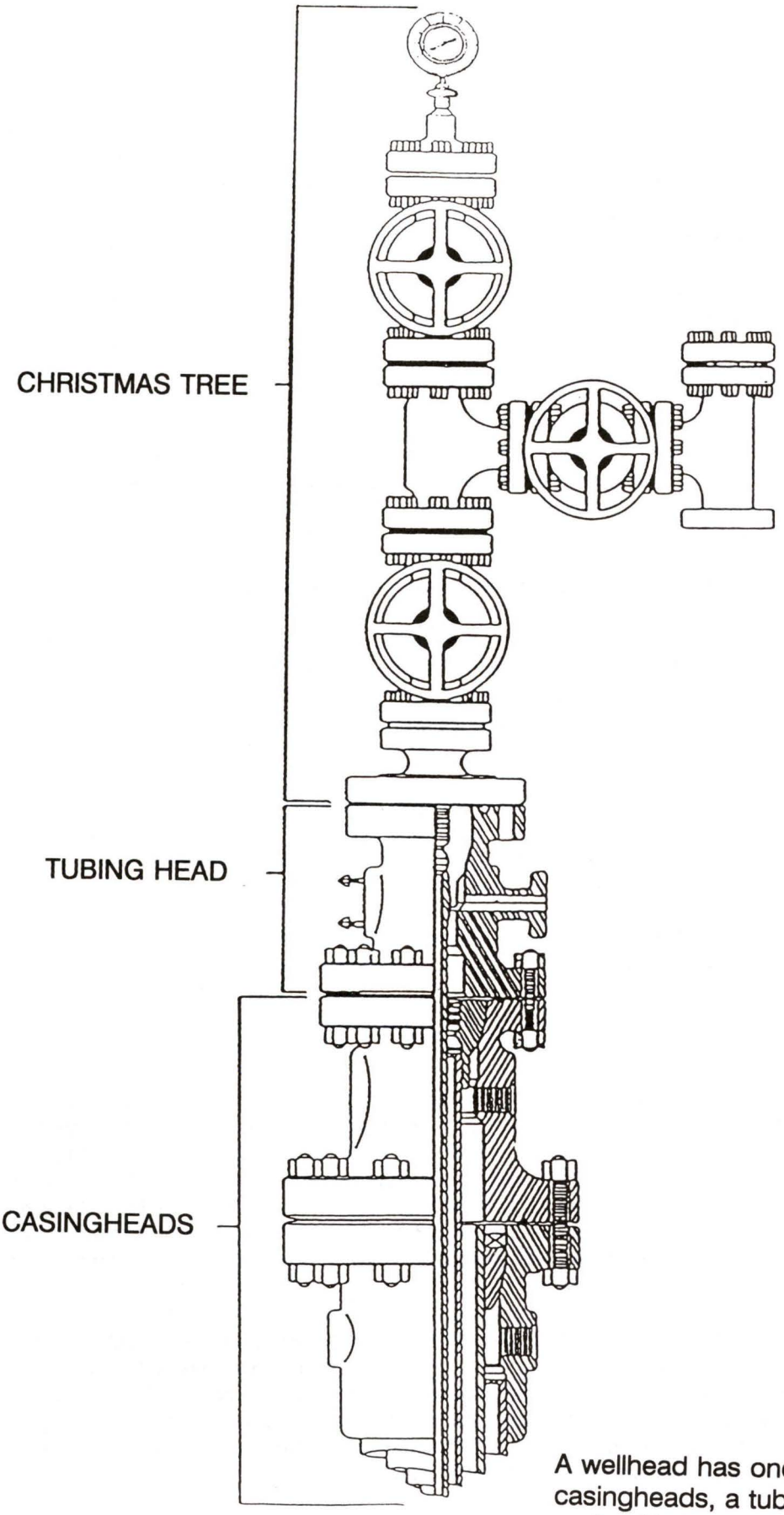
Centrifugal Pumps - Centrifugal submersible oil well pumps consist of a stack of 25 to 300 electric powered small pumps located inside the well casing. Centrifugal pumps require little equipment above the ground and generate no noise at the surface. Surface equipment requirements include a switch or control cabinet, the wellhead, a spool for the cable used to transmit electricity to the pumps, and an electric powerline.

Hydraulic Pumps - The pumping unit of a hydraulic system is located inside the well and is powered by oil under high pressure. The equipment required on the surface includes a storage tank for the power oil, a pump to pressurize the oil, an electric motor or internal combustion engine to power the oil pump, power oil regulating valves and pressure gauges, hydraulic pump and the oil wells. The total surface area used for this type of facility may be greater than for other pumping systems if a centralized power system and additional oil pressure lines are used to carry the power oil from the pump to the wellheads. The noise level created at the wellhead depends on whether an electric motor or internal combustion engine is used to power the oil pump.

Gas Lift - Gas lift is commonly used where low-cost, high pressure natural gas is available and where pressure in the petroleum reservoir is sufficient to force the petroleum part of the way up the well. In this system natural gas under pressure is injected into well casing. The gas forces the fluids up the production tubing to the surface. The gas pressure maintained inside the casing creates a flowing well. The surface equipment used for gas lift includes gas compressor, oil storage tank, and separator. The system is quiet if the compressor is powered by electric motor and little physical space is required at the wellhead.

FIGURE 5

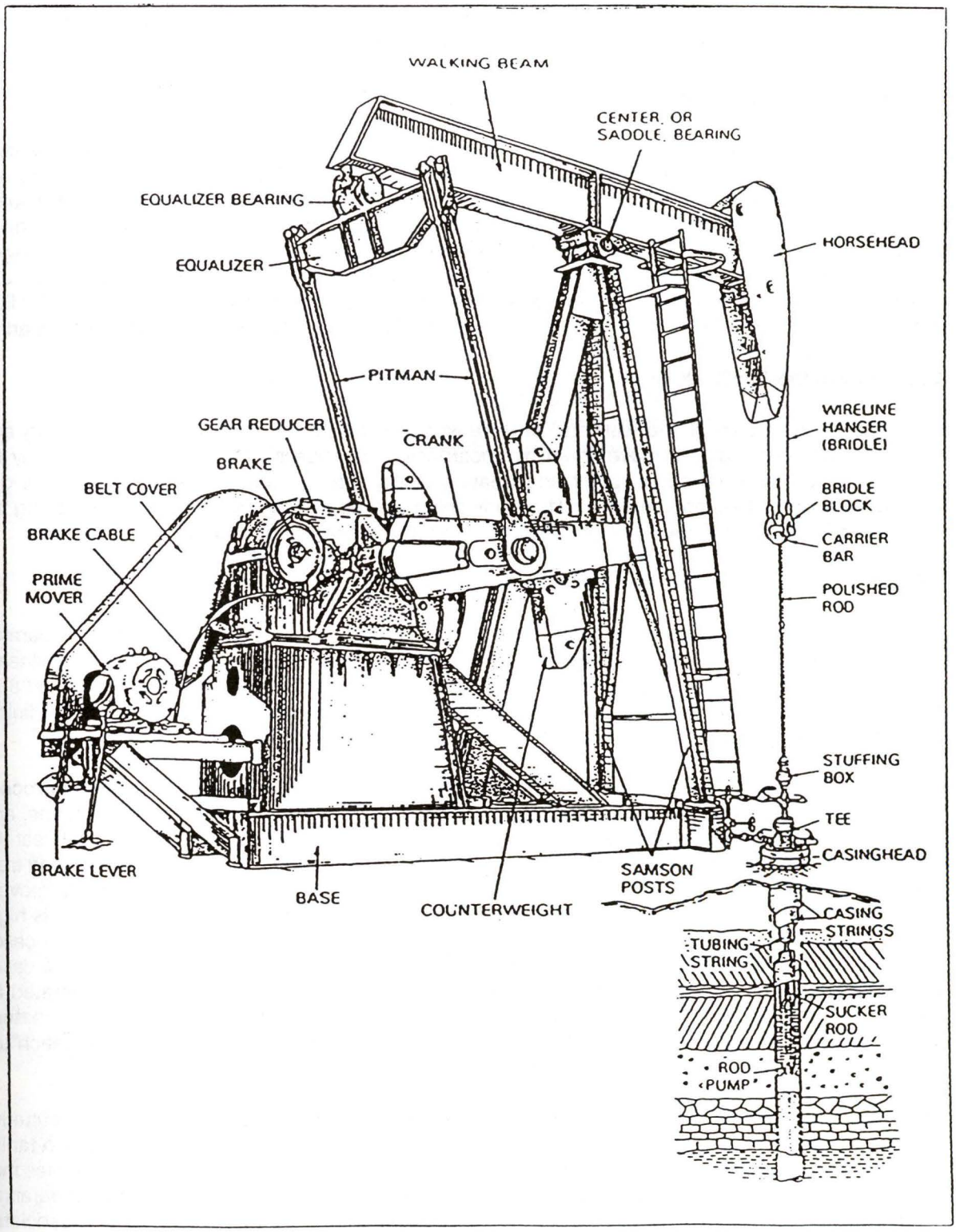
A Wellhead



A wellhead has one or more casingheads, a tubing head, and a Christmas tree.

Figure 6

Sucker Rod Pump Unit



5. Gas Wells

Most gas wells produce by normal flow and, in most cases, do not require pumping. Surface use at a flowing gas well usually is limited to a 20-foot by 20-foot fenced area. Water may enter a gas well and choke off the gas flow. A pump is then installed to pump off the column of water. Some gas wells may require periodic to almost continual water pumping. The typical gas wellhead facilities are similar to those of a flowing oil well, consisting of a relatively unobtrusive wellhead "Christmas tree".

6. Oil Field Gathering Systems

Crude oil is transferred in small diameter pipelines called "flowlines" from the wells to treatment facilities and central tank storage battery before it is transported from the lease. The flowlines may be constructed with 3 or 4 inch diameter steel pipes, but plastic pipe is more commonly used. Flowlines are usually buried, however, under certain circumstances, may be elevated above the ground. The installation of flowlines is similar to small scale pipeline construction. Generally, a level bed is constructed to provide for vehicle access, trenching, and burial of the flowline. Flowlines are often installed in, or adjacent to, a roadbed to reduce surface disturbance and facilitate its installation. After the oil is gathered from the field and is treated, measured, and tested, it will be transported from the lease by pipeline or trucked to market.

7. Gas Field Gathering Systems

Natural gas is often sold at the wellhead and transported directly off the lease. If processing and conditioning are required to remove liquid hydrocarbons, "acid gases", and water, the gas may be transferred to a central collection point and treating facility through flowlines prior to sale. All gas gathering systems include equipment for (1) conditioning and upgrading the gas; (2) compressing the gas so that it flows through the pipelines; and (3) controlling, measuring, and recording its flow.

8. Oil and Gas Separating, Treating, and Storage Facilities

Fluids produced from a well normally contain oil, gas, and water. The oil, gas, and water are separated or treated before the oil is stored in the tank battery. The treating facilities may be located at the wellhead, but in a fully developed field, they are usually located at the tank battery site. (See Figures 7 and 8). If enough "natural gas" is produced with the oil to warrant separation, it will be separated from the fluids, compressed, and pipelined direct to market.

Enough "casinghead gasoline" or "drip gas" may be produced in the field to make it economical to process it for marketing. A "gasoline" plant may then be built in the area to remove natural gasoline, butane, and propane. Some of the residue gas may be used to fuel gas compressors, pump engines, and heat the separating and treating vessels. The remainder of the gas is marketed. The oil and water produced from a well are usually in the form of an emulsion. Water is separated and removed after the gas is removed. The type of treatment facilities used depends on the amount of emulsification. If emulsification is high, chemical and/or heat treatment is used to separate the oil and water. Heat is applied in a facility called a "heater-treater" which breaks the oil in water emulsification. The heat is supplemented in most cases by chemical emulsion breakers. The oil and water, when not highly emulsified, may be separated by gravity in a tall settling tank called a "gun barrel". Conditioning equipment such as separators, heaters, dehydrators, and compressors may be located at the wellhead where the oil and gas first reach the surface or at the tank batteries and/or gas compressor stations in the field.

After the oil and water are separated, the oil is piped to storage tanks (tank batteries). The tank batteries are usually located on, or in the vicinity of, the lease. Tank batteries usually contain at least two tanks. The number and size of tanks vary with the rate of petroleum production from the field. Small leases may contain only one tank battery; large leases or units may contain several, each with its own separating, treating, and storage facilities. Tank battery sites may occupy from 1 to 5 acres depending on associated facilities and number and size of tanks.

Although natural gas is produced in varying quantities with the crude oil, in many fields the primary or sole production is the natural gas itself. The field processing to upgrade the gas for transportation and marketing consists of two primary treatments. The first is to separate the natural gas from crude oil and/or other liquid condensates including free water. In this process the gas is run through "separators" and "heater" to separate the liquids from the gas. The gas is then run through a "dehydration unit" to remove the remaining water vapor. The removal of the water vapor is important since in the presence of natural gas or other hydrocarbons it will form "hydrates" which precipitate out and cause blockage of pipelines. The treatment of the gas is done either at the wellhead or at a centralized field facility located at the tank battery site or at a compressor plant. No gas is stored at these facilities but is entered directly into a marketing pipeline after treatment.

Hydrogen sulfide (H_2S) and carbon dioxide (CO_2) are "acid gases" commonly produced with the natural gas. H_2S is extremely toxic, heavier than air, is highly corrosive to unprotected metal, and will cause eventual failure of the metal. Unless these gases are present in very small quantities they must be removed from the natural gas. There are several processes used to remove "acid gases". The most common is the alkanolamine process in which the gas is absorbed in an alkanolamine solution. Large compressors are used to compress the gas up to, or in excess of, a hundred times the normal atmospheric pressure. Large reciprocating compressors driven by gas engines are used, but centrifugal units driven by gas turbines or electric motors are also used. Large compressor stations along the pipeline often use natural gas from the pipeline for fuel. Compressor stations operate at a high noise level and are normally housed in large metal buildings. Storage and maintenance facilities for the gas field's operations are usually located at the compressor station. Compressor stations are the largest and most visible features in a gas field and are the center of most of the human activity.

9. Disposal of Produced Water

After water is separated from oil at the tank battery, it is disposed of under BLM approval and supervision. Although most produced waters are brackish to highly saline, some produced waters are fresh enough for beneficial surface use.

Produced water from oil and gas operations is disposed of by subsurface injection, lined pits, or other methods acceptable to the BLM, in accordance with the requirements of Onshore Oil and Gas Operating Order Number 7. Disposal of produced water by disposal/injection wells requires permit(s) from the primacy State, (North Dakota is the primacy state for the project area). Approval of surface use by the Forest Service is also required. The state of North Dakota has primacy for the disposal of produced water. The state of North Dakota does not permit surface pit disposal (evaporation) of produced water.

When produced water is disposed of underground, it is introduced or injected under pressure into a subsurface horizon containing water of equal or poorer quality. Produced water may also be injected into the producing zone from which it originated to stimulate oil production. Dry holes or depleted wells are commonly converted for saltwater disposal. Occasionally new wells will be drilled for this purpose.

The State of North Dakota requires that all injection wells be permitted under the Underground Injection Control (UIC) program. Permission is also required from the BLM per Onshore Oil and Gas Operating Order Number 7. Under the UIC approval process, the disposal well must be pressure tested to ensure the integrity of the casing. The disposal zone must also be isolated by use of tubing and mechanical plug call a packer. The packer seals off the inside of the casing and only allows the injected water to enter the disposal zone. The tubing and packer are also pressure tested to ensure their integrity. These pressure tests confirm the isolation of the disposal zone from possible usable water zones. The tests are repeated on a basis set by the State.

FIGURE 7

View of Vertical Heater-treater

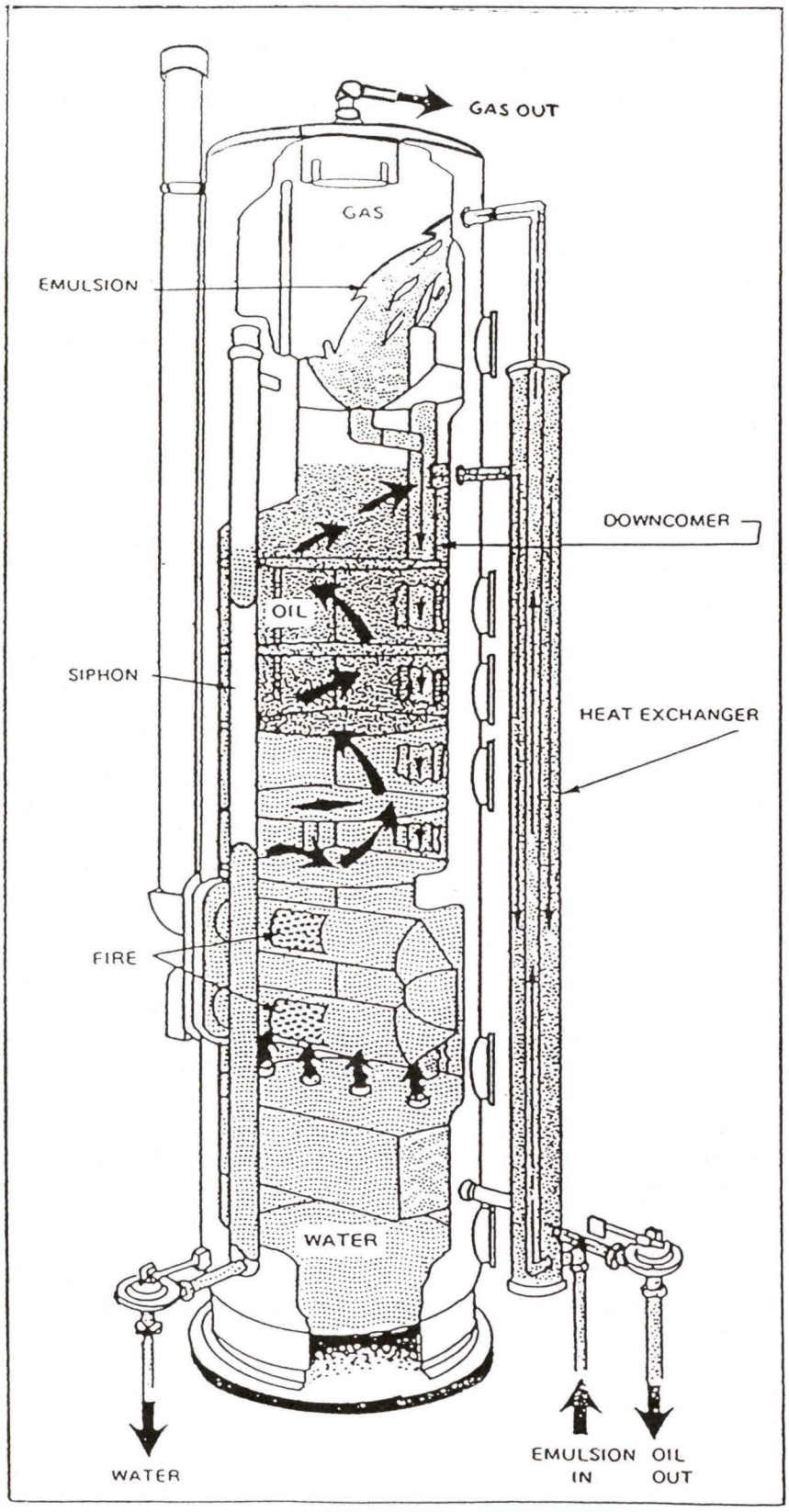
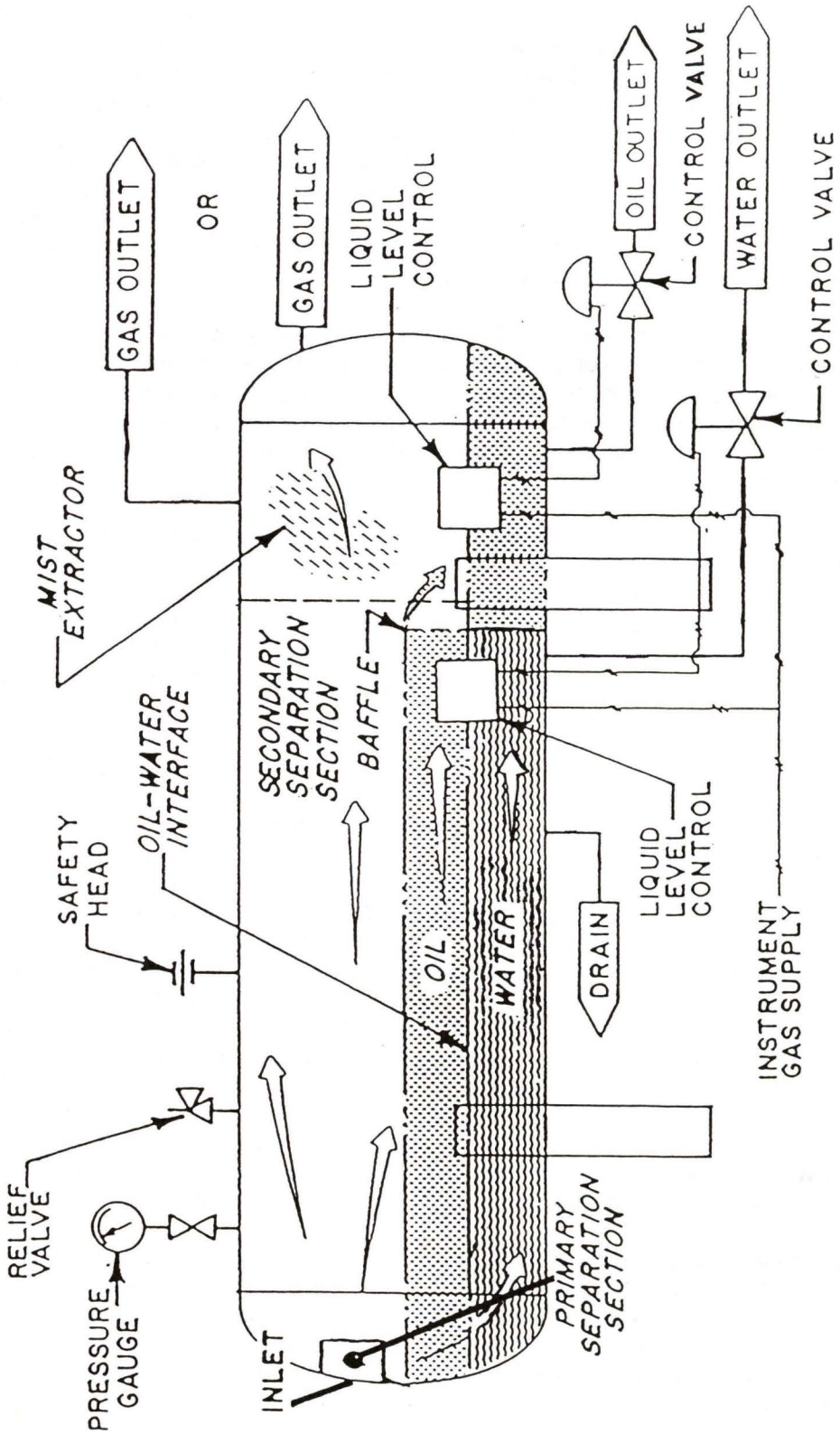


FIGURE 8

Cutaway of Horizontal Separator



10. Secondary and Enhanced Recovery of Oil

Oil, gas, and water are typically trapped within fine rock pores under high pressure in the oil reservoir. Because of the high pressures, much or all of the gas is dissolved in the oil. Expansion of pressurized water and gas in solution forces oil out of the rock pores into the well and up to the surface. This is known as the "primary drive" or "primary recovery". Oil flowing out of the rock drains energy from the formation; pressure in the reservoir begins to slowly decline; primary drive diminishes and the production rate falls. The oil cannot be produced unless pressures within the reservoir are maintained or restored to cause displacement of the oil being held in the rock and to drive it to the wellbore. Usually, only 15 to 20 percent of the oil is recovered from a reservoir during primary production. As reservoir pressures continue to drop, gas in the oil escapes, forming bubbles in the rock pores. This retards the flow of oil and, over time, oil production ceases. Installation and implementation of a secondary and enhanced recovery system significantly increases a field's productivity and longevity. Many reservoirs are developed for secondary and enhanced recovery early in the life of a field.

a. Secondary Recovery Methods - Fluid injection is a secondary recovery operation in which a depleted reservoir is restored to production by the injection of liquids or gases (from extraneous sources) into the wellbore. In essence, this injection restores reservoir pressures and moves the formerly unrecoverable oil through the reservoir to the well. Fluids are injected into selected wells at, or near, original pressure levels to achieve maximum recovery efficiency. Two of the more common fluid injection methods are waterflood and saltwater disposal.

The installation of a secondary recovery system involves drilling of injection wells and new recovery wells or conversion of production wells to injection wells. Fluid injection lines are installed and additional water separation and storage facilities constructed to implement the secondary recovery system. Secondary recovery results in a significant increase in the amount of water produced. Additional land area is needed to accommodate water supply facilities, water storage and treating facilities, water injection pumps, and waterlines to wells. Drilling and construction and other human activities intensify in the oil field during installation of a fluid injection system.

Waterflood - The most commonly employed form of secondary recovery is waterflooding. Water is injected into the reservoir under pressure to drive additional oil to the producing wells. On the average, a successful waterflood doubles the amount of oil recovered from a reservoir. In some fields, water for waterfloods is injected into depleted existing wells. In other cases, additional wells may need to be drilled for water injection. Most waterfloods are difficult to operate on a lease basis, so entire fields, if not already being operated under a unitization agreement, are usually unitized before flooding. If unitization precedes a waterflood, there is little or no duplication of secondary recovery facilities. However, additional surface area is used for the water supply facilities, water storage and treating facilities, water injection pumps, and waterlines to injection wells. If the injection well is a converted producing well, the waterline replaces the producing flowline. If the injection well is a converted dry hole or a new well drilled for the waterflood, the water injection line is the only addition to the pipeline system and requires the same amount of land as a flowline for a producing well.

Gas Injection - Gas injection is a secondary recovery technique that is generally used only in oil and gas reservoirs which have an existing gas cap. Natural gas is injected under pressure to restore and maintain reservoir pressures to displace and move oil to the producing wells.

Saltwater Disposal - Although not a secondary recovery process, per se, saltwater disposal is a common form of fluid injection. Its primary purpose is simply to dispose of the saltwater produced with crude oil. A typical system is composed of collection centers in which saltwater from several wells is gathered, a central treating plant in which corrosion-forming substances are removed, and a disposal well. The saltwater is injected into the originating zone and used to pressurize and drive the oil towards the borehole of a producing well. (See Disposal of Produced Water.)

b. Enhanced Recovery Methods (Tertiary recovery) - Enhanced recovery methods increase the amount of oil produced and recovered from an oil reservoir beyond that obtained from primary and secondary

methods. Enhanced oil recovery techniques employ chemicals, water, gases, and heat singly, and in combination, to reduce the factors that inhibit oil recovery. Considerable technical and financial risk is involved because of the large investment in equipment and the unknown factors or characteristics of the oil reservoir that may affect the success of an enhanced recovery method. There are three broad categories of enhanced recovery methods currently used; namely (1) thermal enhancement, which primarily involves injecting high pressure steam into the oil reservoir to reduce oil viscosity and increase its ability to flow; (2) miscible flood, in which propane, butane, natural gas, CO_2, or other gases are injected into the reservoir to dissolve and displace the oil; and (3) chemical enhancement, which includes injecting polymers to thicken injected waters which increase uniformity of oil displacement in the reservoir or injecting detergents ("surfactants") that essentially "wash" the oil from the reservoir rocks.

As with secondary recovery systems, additional land surface is required to accommodate the injection and oil recovery systems. This includes additional wells, injection lines and flowlines, roads, storage, and treatment facilities, pumps, and injection equipment. There is also an increase in construction and drilling activities during the installation of all enhanced recovery systems.

11. Transportation Pipelines

A transportation pipeline is needed in order to transport natural gas and oil to market or refineries. In most cases, oil is transported to the refinery via a pipeline, although trucks may be used to transport oil from isolated fields or new fields to pipeline terminals or the refinery.

Oil is moved through the pipeline by pumps. Pump stations are located either at gathering stations or trunkline stations or a combination of both. A gathering station is located in or near an oil field and receives oil through a pipeline gathering system from the operators' tanks. From the gathering station, oil is relayed to a trunkline station, which is located on the main pipeline, or trunkline. The trunkline station relays the oil to refineries or shipping terminals. To maintain pressure, booster pumps are spaced along the trunkline. Tank batteries located along the line receive and temporarily store the oil before it continues.

Months and sometimes years of engineering studies and surveys of potential gas reservoirs and markets precede the final decision to build a pipeline.

Construction of a large transportation pipeline may involve as many as 250 to 300 men in a normal operation and up to 500 men in a very large operation. The amount of construction equipment needed depends on the variety and difficulty of terrain. Stream crossings, marshes, bogs, heavily timbered forests, steep slopes, or rocky ground can require different types of equipment and construction practices. 250 to 300 men can move at a rate of 3 miles a day with a distance of sometimes 10 or 15 miles separating the beginning of the work crew from the end.

In practice, a strip of land from 50 to 75 feet wide is cleared depending on the size of the pipe and the type of terrain. The clearing crews open fences and build gates, cattle guards, and bridges. Salable timber cut by clearing crews is stacked; the rest is cut and disposed of. A roadway capable of supporting vehicle access is graded and completed adjacent to the pipeline. The cleared area needs to be wide enough for the pipeline trench, the largest side-boom tractor, and transportation of pipe and equipment. In rocky terrain, a machine equipped with a ripper that extends several feet into the ground is often used to loosen rocks for removal before the ditching operation begins.

A ditch is made by loose-dirt ditching machines or by wagon drills suspended from side-boom tractors. Dynamite blasting is used for very hard rock surfaces. Pipe is transported to the ditching sites where the pipe is coated, double jointed, welded, and lowered into the ditch. The pipe must be buried deep enough to ensure that it does not interfere with normal surface uses. The Department of Transportation requires a minimum of 36 inches of cover. The trench is backfilled, compacted, and the cleared area waterbarred, and revegetated.

12. Well Servicing and Oil and Gas Field Maintenance

Producing wells in active oil and gas fields periodically require repair and workover operations. Operations involving no new surface disturbance to redrill, deepen, and plug-back require prior approval of the authorized officer of the BLM. In some cases, these operations require the approval of the Forest Service.

No prior approval or subsequent report is required for well cleanout work, routine well maintenance, bottom hole pressure survey, or for repair, replacement, or modification of surface production equipment provided no additional surface disturbance is involved.

When prior approval is required, the operator must submit a Sundry Notice, or APD, as applicable. A detailed written statement of the plan of work must be provided to the authorized officer with the appropriate form. When additional surface disturbance will occur, a description of any subsequent new construction, reconstruction, or alteration of existing facilities, including roads, damsites, flowlines and pipelines, tank batteries, or other production facilities on any lease, must be submitted to the authorized officer for environmental reviews and approvals. On NFS lands, the BLM coordinates with the Forest Service to obtain their approval on the surface disturbing activities. Emergency repairs may be conducted without prior approval provided the authorized officer is promptly notified.

The servicing of individual wells to improve or maintain oil and gas production is an activity that extends throughout the life of the field. This work is usually performed with the use of a well servicing unit or self propelled workover rig which is similar to a scaled down oil rig. Both the workover rig or well servicing unit carry hoisting machinery that is used to pull sucker rods and tubing from the wellbore. The most common well servicing operations conducted are: cleaning out the well, changing pumps, repairing rod string and tubing, changing the producing and reestablishing oil producing intervals, installing artificial lift, and repairing casing and other downhole equipment. There is an intense, but short term, increase in human and motorized activity at the wellsite during servicing.

Construction, reconstruction, and normal maintenance work continue throughout the field's life. Flowlines, pipelines, pumping units and other oil and gas field equipment which is no longer functional because of corrosion, metal fatigue, wear, or because it has become outdated and inefficient is replaced, upgraded, or abandoned and removed. Major and minor maintenance activities are a normal part of the operations during the life of the oil and gas field.

13. Pollution Control

All spills or leakages of oil, gas, produced water, toxic liquids or waste materials, blowouts, fires, personal injuries, and fatalities must be reported by the operator to the BLM and the surface management agency in accordance with the requirements of Notice to Lessees 3A, (NTL 3A), "Reporting of Undesirable Events", or an applicable Onshore Oil and Gas Order. The BLM requires immediate reporting of all Class I events (more than 100 barrels of fluid/500 MCF of gas released or fatalities involved). A "spill prevention, control, and countermeasure plan" is required by the Environmental Protection Agency under 40 CFR Part 112 and any discharge of oil (oil spill) must be reported immediately to the National Response Center, EPA (See 40 CFR 110).

Firewalls/containment dikes must be constructed and maintained around all storage facilities/batteries. The containment structure must have sufficient volume to contain, at a minimum, the entire content of the largest tank within the facility/battery, unless more stringent site-specific protective requirements are deemed necessary by the authorized officer.

14. Inspection and Enforcement

The BLM and Forest Service have developed procedures to ensure that leaseholds which are producing or expected to produce significant quantities of oil or gas in any year, or have a history of noncompliance, are inspected at least once a year. Other factors such as health, safety, and environmental concerns, and potential conflict with other resources also determine inspection priority. Inspections of leasehold opera-

tions ensure compliance with applicable laws, regulations, lease terms, Onshore Oil and Gas Orders, NTL's, other written orders of the authorized officer, and the approved plans of operation. The administration of oil and gas operations on NFS lands is conducted in accordance with 36 CFR 228.111 through 36 CFR 228.114 and Bureau of Land Management oil and gas regulations 43 CFR 3160.

E. ABANDONMENT (PHASE 5)

All abandonments, whether they involve one exploratory oil and gas well, a well no longer productive, or an entire leasehold, require the approval and acceptance of the abandonment of the individual well(s) by the BLM and the Forest Service. An acceptable abandonment includes (1) the plugging of the wellbore and (2) reclamation of the land surface to a stable and productive use.

1. Approval of Abandonment

Well abandonment operations may not be started without prior approval of a "Sundry Notices and Reports on Wells" by the authorized officer of the BLM. The Sundry Notice serves as the operator's Notice of Intent to Abandon (NIA). In the case of newly drilled dry holes, failures, and in emergency situations, oral approval may be obtained from the authorized officer followed by written confirmation. In such cases, the surface reclamation requirements will have been discussed with the operator and be included in the approved APD. Additional surface reclamation measures may be required by the Forest Service. For older existing wells, not having an approved surface use plan of operations, a reclamation plan must be submitted with the NIA. Reclamation requirements are part of the approval of the NIA. The operator must contact the BLM prior to plugging a well to allow for approval and witnessing of the plugging operations.

a. Plugging of Wells - The purpose of plugging a well is to prevent fluid migration between zones within the wellbore, to protect other minerals from damage, and to prevent escape of well gas or fluids to the surface. Well plugging requirements vary with the characteristics of the rock, geologic strata, well design, and reclamation requirements.

Drilling well or open hole situations: The plugging of drilling wells or open holes must be in accordance with Onshore Oil and Gas Order No. 2. These requirements specify that cement plugs must extend at least 50 feet above and below zones with fluid which has the potential to migrate, zones of lost circulation, and zones of potentially valuable minerals. Thick zones may be isolated using 100 foot plugs across the top and bottom of the zones. In the absence of productive zones and minerals, the long sections of open hole are plugged with 100 foot plugs spaced every 3,000 feet. A 100 foot cement plug is placed across the surface casing shoe (the bottom of the surface casing). This plug must extend at least 50 feet below the shoe and 50 feet above the shoe (inside the surface casing).

All cement plugs must have sufficient volume to fill 100 feet of hole plus an additional volume of 10 percent per 1000 feet of depth (a 100 foot plug at 5000 feet would be required to have an additional 50 feet of cement). The surface shoe plug is tested by tagging with drillpipe. Tagging is accomplished by setting the weight of the drillpipe down on the cement plug to establish that a competent plug exists at the depth specified. Since the surface casing protects aquifers, the surface shoe plug provides the last means of protection if the other downhole plugs should fail. The top of the surface casing is plugged with a minimum of 50 feet of cement.

Depleted producers or cased hole situations: For cased holes, all perforations must be isolated so as not to allow fluid to migrate up hole or to the surface. The perforations may be isolated by: 1) placing a cement plug across the perforations and extends 50 feet above and below the perforations, or 2) setting a cement retainer (cement tool that acts like a plug except that cement can be pumped below the tool but no fluid can pass above the tool) +/- 100 feet above the perforations and pumping a sufficient volume of cement into the perforations, or 3) setting a bridge plug (a tool similar to a cement retainer except that no fluid can pass in either direction) +/- 100 feet above the perforations and placing 50 feet of cement on top of the bridge plug. The production casing may be removed. If the casing is cut and removed, the casing stub (the top of the casing remaining in the hole) must be plugged with a 100 foot cement plug to extend 50 feet inside the casing stub and 50 feet outside the casing stub (open hole). If casing is

removed, the surface casing is plugged as described under open hole situations. If the casing is not removed, the surface casing shoe must be isolated by perforating the production casing near the surface casing shoe. A cement retainer must be set +/- 100 feet above the perforations and a sufficient volume of cement is pumped below the retainer, through the perforations, and between the outside of the production casing and the inside of the surface casing for a distance of 100 feet. All cement plugs must have sufficient volume to fill 100 feet of hole plus an additional volume of 10 percent per 1000 feet of depth (a 100 foot plug at 5000 feet would be required to have an additional 50 feet of cement). At the surface, all annular spaces must be plugged with at least 50 feet of cement. No tagging of the surface casing shoe plug is required if the plug was placed through a cement retainer. All cement retainers of bridge plugs must be capped with a minimum of 50 feet of cement.

A permanent abandonment marker is required on all wells unless waived. This marker pipe is usually 4 feet above the ground and embedded in cement at the borehole site. The pipe is capped and the wells identity and location permanently inscribed.

Dry exploratory oil and gas and development wells are normally plugged before the drill rig is removed from the wellsite. This allows the drill rig to plug the hole and avoid the necessity of bringing in other plugging equipment.

Before a lessee/operator abandons a well no longer capable of production, it must be shown that it is no longer suitable for profitable operation. Wells are normally plugged when they are no longer capable of production. However, if a well has potential for use in a secondary recovery program, it may be allowed to stand idle. Truck-mounted equipment is used to plug former producing wells.

b. Surface Reclamation - A reclamation plan is a part of the surface use plan of operations. Reclamation may be required of any surface previously disturbed that is not necessary for the continued well or other operations. When abandoning a well and other facilities that do not have a previously approved reclamation plan, a plan must be submitted with a Notice of Intent to Abandon (NIA). Additional reclamation measures may be required based on the conditions existing at the time of abandonment. Any additional reclamation requirements are made part of the conditions of approval of the NIA. The general standards and guidelines for reclamation and abandonment of oil and gas operations are set forth in the third edition of the Surface Operating Standards for Oil and Gas Exploration and Development. Additional standards and requirements may be applied to accommodate the site-specific and geographic conditions of the reclamation site.

Prior to the start of reclamation, all equipment and trash must be removed from the wellsite or the area to be reclaimed. When an entire lease is abandoned, the separators, heater treaters, tanks, and other processing and handling equipment are removed and the surface restored. Flowlines and injection lines installed on the surface are removed, but buried lines usually are left in place.

Wellsite Reclamation - Wellsite reclamation must be planned on both producing and abandoned wellsites. The entire site, or portion not required for the continued operation of the well, is reclaimed.

When they are dry, all excavations and mud pits must be closed by backfilling and graded to conform to the surrounding terrain. Waterbreaks and terracing may be installed to prevent erosion of fill material.

Cut and fill slopes must be reduced and graded to blend the site to the adjacent terrain. The wellsite may be recontoured by bringing the construction material back onto the well pad and reestablishing the natural contours where desirable.

The topsoil is replaced on the reclamation area and prepared to provide a seedbed for reestablishment of desirable vegetation. Standard reclamation practices may include contouring, terracing, gouging, scarifying, mulching, fertilizing, seeding, and/or planting.

Reserve Pit Reclamation - All pits must be reclaimed to a natural condition similar to the rest of the reclaimed wellsite area. In addition, the reclaimed pit must be restored to a safe and stable condition. In

most cases, if a pit contains a synthetic liner, the pit is not to be trenched (cut) or filled while still containing fluids. Pits must be allowed to dry, be pumped dry, or solidified by adding fly ash. The pit area is usually mounded to allow for settling. The mounding allows for positive surface drainage off the reclaimed pit, which lessens the possibility of leaching or lateral movement of undesirable substances from the buried pit into surface streams or shallow aquifers.

The concentration of hazardous substances in the reserve pit at the time of pit backfilling must not exceed the standards set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). All oil and gas drilling-related CERCLA hazardous substances removed from a location and not reused at another drilling location are disposed of in accordance with applicable state and Federal regulations.

Road Reclamation - Roads no longer needed for oil and gas operations and not within the Forest Service Transportation System must be abandoned, closed, and obliterated. Reclamation of abandoned roads will involve one or more of the following techniques: (1) recontouring to the original contour; (2) recontouring to blend with natural contours; (3) recontouring only selected sections of the roadway; and (4) obliteration of the roadway surface with no other modification of the road profile. Reclamation treatments may also include ripping, scarifying, water-barring, and barricading. Stockpiled soil, debris, and fill materials are replaced on the roadbed and the road reseeded in accordance with the approved site-specific reclamation plan.

Pipeline and Flowline Reclamation - Abandonment and reclamation of pipelines and flowlines, similar to the reclamation of abandoned roads involve replacing fill material in the original cuts, reducing and grading cut and fill slopes to conform to the adjacent terrain, replacement of surface soil material, waterbarring and revegetating in accordance with the reclamation plan.

Pipeline trenches are compacted during backfilling and must be maintained to correct backfill settling and prevent erosion. Waterbars and other erosion control devices are repaired or replaced as necessary.

Revegetation - Disturbed areas are revegetated after the site has been contoured, graded, and the soil surface satisfactorily prepared. In order to minimize the soil erosion potentials and provide a stable seed bed, site preparation may include ripping, contour furrowing, terracing, reduction of steep cut and fill slopes, waterbarring, etc. Revegetation involves seeding, planting of containerized plants, or a combination of the two. Native perennial species, or other plant materials specified by the Forest Service are used. The oil and gas operator is advised as to species, methods of revegetation and seasons to plant. Seeding is normally done by drilling on the contour or by other approved methods. Seeding and/or planting is repeated until satisfactory revegetation is accomplished, as determined by the Forest Service. Mulching, fertilizing, fencing, or other practices may also be required depending on site-specific conditions.

Visual Resources - For all activities which alter landforms, disturb vegetation, or require temporary or permanent structures, the operator is required to comply with visual resource management objectives for the area. Site-specific mitigation practices may be required by the Forest Service to avoid or minimize changes in the character of the landscape or minimize the impacts of unnatural intrusions on the landscape.

Additional Requirements - Additional reclamation methods and techniques that reflect local site conditions are required. Technical advances in reclamation practices that may be successfully applied to oil and gas construction are continually being developed.

2. Inspection and Final Abandonment Approval

Final abandonment is not approved until the surface reclamation work required by the APD or NIA is completed and the required reclamation is acceptable to the surface managing agency. The operator must file a Subsequent Report of Abandonment (SRA) following the plugging of a well. A Final Abandonment Notice (FAN) which indicates that the site is ready for inspections must be filed upon completion of reclamation.

3. Release of Bonds

If the well is covered by an individual lease bond, the period of liability on that bond is terminated once the final abandonment or phased bonding release has been approved. The principal can request termination of the period of liability from the BLM State Office holding the bond. If the well is covered by a statewide or nationwide bond, termination of the period of liability of these bonds is not approved until final abandonment of all activities conducted under the bond have been approved by both the BLM and Forest Service.

APPENDIX D

MITIGATION MEASURES FOR LEASING ALTERNATIVE E-7

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX D

This Appendix identifies and discusses the following:

A. Definitions of Mitigation Measures,

B. Mitigation Measures, as applied to the Preferred Alternative E-7,

C. Lease Notices, and

D. Visual Resource Management Guidance.

A. DEFINITIONS OF MITIGATION MEASURES

Mitigation measures include the **stipulations** that apply to drill pad location, construction and use, and **Forest Plan Management Standards** that apply to all other on-lease activities and all off-lease activities on NFS lands.

These mitigation measures apply to Federal mineral estates only, and are not intended to restrict activity on private minerals. However, they can be further used by the Medora District in evaluating access to private minerals across NFS surface estates wherever the resources evaluated in this document are encountered.

1. Standard Lease Terms

Standard lease terms are those included on BLM Form 3100-11, and describe the minimum mitigation measures available to the Authorized Officer for drill pad location and use at the APD stage of oil and gas operations, as described in Section 6 on the form. These measures include the authority to relocate proposed operations up to 200 meters, and to delay operations up to 60 days in any lease year (43 CFR 3101.1-3).

2. Stipulations

Stipulations are provisions that modify standard lease rights and are attached to and made a part of the lease. They are necessary modifications of the terms of the lease when conflicts between resources and oil and gas activities cannot be adequately managed and/or accommodated under standard lease terms. Stipulations attached to leases at the EIS stage apply to the resources as mapped at the time of the Leasing Decision. They may be necessary if the authority to control oil and gas activities on the lease does not already exist under laws, regulations, or operational orders. They include No Surface Occupancy (NSO), Controlled Surface Use (CSU) and Timing Limitations (TL).

Stipulations only apply to the drill pad; its location, construction and use. Stipulations are only binding on the lease holder, and by themselves, do not regulate access and other related development and production activities. Stipulations also do not control other similar activities on the lease, such as roads for other projects, and oil and gas roads, pipelines and transmission lines needed to access and service neighboring leases. These other uses are covered through the Forest Plan Management Standards.

The following stipulations are in accordance with the "Uniform Format for Oil and Gas Leasing Stipulations", as standardized in March, 1989 by the Rocky Mountain Regional Coordinating Committee, and were adopted by Custer National Forest in the Forest Plan Amendment #1 on March 29, 1991:

•No Surface Occupancy (NSO)

The NSO stipulation is intended for use only when other stipulations are determined insufficient to adequately protect the resource values. An NSO stipulation is not needed if the desired protection could be accomplished by relocating proposed operations 200 meters or less as allowed under Standard Lease Terms. Generally, the Forest Plan Management Standards will preclude access and construction of other related facilities through resource areas that require an NSO stipulation. Also, surface occupancy generally would not be permitted in NSO areas in order to protect the Federal mineral estate in drainage cases.

•Controlled Surface Use (CSU)

The CSU stipulation is intended to be used when fluid mineral occupancy and use are allowed on all or portions of the lease area year-round, but because of special resource concerns or values, lease activities must be strictly controlled. It will be used in areas where restrictions or controls are necessary for specific types of activities rather than all activities, and applies to development as well as production phases. It may be used to move drill pads further than 200 meters to protect a resource that is too small or extremely difficult to map, such as heads of canyons. The exact restriction will be determined at the APD level, however, the general requirements of this stipulation are included in this appendix for each resource.

•Timing Limitation (TL)

The TL stipulation prohibits fluid mineral exploration and development activities for a time period of less than one year, and applies to all on-lease activities. It is intended to provide additional protection from exploratory drilling and construction in areas that may have important seasonal use, such as raptor nest sites and recreation use areas. If exploration is successful, the construction phase would end, the site would be stabilized, and the less intrusive production phase would begin on a year-round basis. A TL is not necessary if the time limitation involves the prohibition of new surface disturbing operations for periods of less than 60 days.

• Waivers, Exceptions and Modifications (WEMs)

A stipulation is subject to waiver, exception or modification if the Authorized Officer determines that the factors leading to its inclusion in the lease have changed sufficiently to make the protection provided by the stipulation no longer justified. Waivers, exceptions or modifications will be considered in accordance with the requirements of Title 36 CFR 228.104. Environmental analysis meeting the requirement of NEPA will be conducted in considering the request. The Authorized Officer's decision will be based on this information. Conditions WEMs will be discussed with each resource stipulation according to the following criteria (RMRCC, 1989):

Waivers can be granted if the condition described in the stipulation no longer applies anywhere within the leasehold.

Exceptions can be granted on a case by case basis if the resource needing protection is not present in the area proposed for disturbance, or if the operator submits a plan that adequately protects the resource.

Modifications are similar to exceptions, but broader in scope, and involve a fundamental change to the provisions of the stipulation. They can be granted either temporarily or for the duration of the lease.

3. Forest Plan Management Standards

National and Regional policies, standards and guidelines have been established for National Forests and National Grasslands. The Custer Forest Plan Management Standards are intended to supplement the National and Regional policies in order to regulate all activities on NFS lands. These standards have been developed for each use of NFS lands, and are specific to each Management Area. They can be used to adjust the construction and location of roads in order to protect against adverse impacts from such things as sedimentation, visual concerns, and impacts on wildlife due to construction and/or heavy truck traffic. They can also be used to control the amount of traffic on the roads. All access and other oil and gas development and production related activities on and off lease are regulated by these Management Standards.

4. Lease Notices

Lease Notices provide more detailed information concerning limitations that already exist in law, regulations, or operational orders. Lease Notices also address special items the lessee should consider when planning operations, but do not impose new or additional restrictions. Lease Notices attached to leases should not be confused with Notices to Lessees, which are specific written Notices issued by the BLM or Forest Service to implement onshore oil and gas orders and CFR regulations (see 36 CFR 228.105 and 43 CFR 3160.0-5).

Form 3100-11
(October 1992)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

OFFER TO LEASE AND LEASE FOR OIL AND GAS

Serial No.

The undersigned *(reverse)* offers to lease all or any of the lands in Item 2 that are available for lease pursuant to the Mineral Leasing Act of 1920, as amended and supplemented (30 U.S.C. 181 et seq.), the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351-359), the Attorney General's Opinion of April 2, 1941 (40 Op. Atty. Gen. 41), or the

READ INSTRUCTIONS BEFORE COMPLETING

1. Name
   Street
   City, State, Zip Code

2. This application/offer/lease is for: *(Check only One)* ☐ PUBLIC DOMAIN LANDS ☐ ACQUIRED LANDS (percent U.S. interest _____)
   Surface managing agency if other than BLM: _____ Unit/Project _____
   Legal description of land requested: *Parcel No.:_____ *Sale Date (m/d/y):_____ / _____ / _____
   ***SEE ITEM 2 IN INSTRUCTIONS BELOW PRIOR TO COMPLETING PARCEL NUMBER AND SALE DATE.**

T.	R.	Meridian	State	County

Total acres applied for _____

Amount remitted: Filing fee $ _____ Rental fee $ _____ Total $ _____

DO NOT WRITE BELOW THIS LINE

3. Land included in lease:

T.	R.	Meridian	State	County

Total acres in lease _____

Rental retained $ _____

This lease is issued granting the exclusive right to drill for, mine, extract, remove and dispose of all the oil and gas *(except helium)* in the lands described in Item 3 together with the right to build and maintain necessary improvements thereupon for the term indicated below, subject to renewal or extension in accordance with the appropriate leasing authority. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of this lease, the Secretary of the Interior's regulations and formal orders in effect as of lease issuance, and to regulations and formal orders hereafter promulgated when not inconsistent with lease rights granted or specific provisions of this lease.

NOTE: This lease is issued to the high bidder pursuant to his/her duly executed bid or nomination form submitted under 43 CFR 3120 and is subject to the provisions of that bid or nomination and those specified on this form.

Type and primary term of lease:

☐ Noncompetitive lease (ten years)

☐ Competitive lease (ten years)

☐ Other _____

THE UNITED STATES OF AMERICA

by _____
(Signing Officer)

_____ _____
(Title) (Date)

EFFECTIVE DATE OF LEASE _____

4. (a) Undersigned certifies that (1) offeror is a citizen of the United States; an association of such citizens; a municipality; or a corporation organized under the laws of the United States or of any State or Territory thereof; (2) all parties holding an interest in the offer are in compliance with 43 CFR 3100 and the leasing authorities; (3) offeror's chargeable interests, direct and indirect, in each public domain and acquired lands separately in the same State, do not exceed 246,080 acres in oil and gas leases (of which up to 200,000 acres may be in oil and gas options), or 300,000 acres in leases in each leasing District in Alaska of which up to 200,000 acres may be in options, (4) offeror is not considered a minor under the laws of the State in which the lands covered by this offer are located; (5) offeror is in compliance with qualifications concerning Federal coal lease holdings provided in sec. 2(a)(2)(A) of the Mineral Leasing Act; (6) offeror is in compliance with reclamation requirements for all Federal oil and gas lease holdings as required by sec. 17(g) of the Mineral Leasing Act; and (7) offeror is not in violation of sec. 41 of the Act.

(b) Undersigned agrees that signature to this offer constitutes acceptance of this lease, including all terms, conditions, and stipulations of which offeror has been given notice, and any amendment or separate lease that may include any land described in this offer open to leasing at the time this offer was filed but omitted for any reason from this lease. The offeror further agrees that this offer cannot be withdrawn, either in whole or in part, unless the withdrawal is received by the proper BLM State Office before this lease, an amendment to this lease, or a separate lease, whichever covers the land described in the withdrawal, has been signed on behalf of the United States.

This offer will be rejected and will afford offeror no priority if it is not properly completed and executed in accordance with the regulations, or if it is not accompanied by the required payments. 18 U.S.C. Sec. 1001 makes it a crime for any person knowingly and willfully to make to any Department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

Duly executed this _____ day of _____ , 19 _____ . _____

(Signature of Lessee or Attorney-in-fact)

LEASE TERMS

Sec. 1. Rentals—Rentals shall be paid to proper office of lessor in advance of each lease year. Annual rental rates per acre or fraction thereof are:

(a) Noncompetitive lease, $1.50 for the first 5 years; thereafter $2.00;
(b) Competitive lease, $1.50; for the first 5 years; thereafter $2.00;
(c) Other, see attachment, or

as specified in regulations at the time this lease is issued.

If this lease or a portion thereof is committed to an approved cooperative or unit plan which includes a well capable of producing leased resources, and the plan contains a provision for allocation of production, royalties shall be paid on the production allocated to this lease. However, annual rentals shall continue to be due at the rate specified in (a), (b), or (c) for those lands not within a participating area.

Failure to pay annual rental, if due, on or before the anniversary date of this lease (or next official working day if office is closed) shall automatically terminate this lease by operation of law. Rentals may be waived, reduced, or suspended by the Secretary upon a sufficient showing by lessee.

Sec. 2. Royalties—Royalties shall be paid to proper office of lessor. Royalties shall be computed in accordance with regulations on production removed or sold. Royalty rates are:

(a) Noncompetitive lease, 12½%;
(b) Competitive lease, 12½%;
(c) Other, see attachment; or

as specified in regulations at the time this lease is issued.

Lessor reserves the right to specify whether royalty is to be paid in value or in kind, and the right to establish reasonable minimum values on products after giving lessee notice and an opportunity to be heard. When paid in value, royalties shall be due and payable on the last day of the month following the month in which production occurred. When paid in kind, production shall be delivered, unless otherwise agreed to by lessor, in merchantable condition on the premises where produced without cost to lessor. Lessee shall not be required to hold such production in storage beyond the last day of the month following the month in which production occurred, nor shall lessee be held liable for loss or destruction of royalty oil or other products in storage from causes beyond the reasonable control of lessee.

Minimum royalty in lieu of rental of not less than the rental which otherwise would be required for that lease year shall be payable at the end of each lease year beginning on or after a discovery in paying quantities. This minimum royalty may be waived, suspended, or reduced, and the above royalty rates may be reduced, for all or portions of this lease if the Secretary determines that such action is necessary to encourage the greatest ultimate recovery of the leased resources, or is otherwise justified.

An interest charge shall be assessed on late royalty payments or underpayments in accordance with the Federal Oil and Gas Royalty Management Act of 1982 (FOGRMA) (30 U.S.C. 1701). Lessee shall be liable for royalty payments on oil and gas lost or wasted from a lease site when such loss or waste is due to negligence on the part of the operator, or due to the failure to comply with any rule, regulation, order, or citation issued under FOGRMA or the leasing authority.

Sec. 3. Bonds—A bond shall be filed and maintained for lease operations as required under regulations.

Sec. 4. Diligence, rate of development, unitization, and drainage—Lessee shall exercise reasonable diligence in developing and producing, and shall prevent unnecessary damage to, loss of, or waste of leased resources. Lessor reserves right to specify rates of development and production in the public interest and to require lessee to subscribe to a cooperative or unit plan, within 30 days of notice, if deemed necessary for proper development and operation of area, field, or pool embracing these leased lands. Lessee shall drill and produce wells necessary to protect leased lands from drainage or pay compensatory royalty for drainage in amount determined by lessor.

Sec. 5. Documents, evidence, and inspection—Lessee shall file with proper office of lessor, not later than 30 days after effective date thereof, any contract or evidence of other arrangement for sale or disposal of production. At such times and in such form as lessor may prescribe, lessee shall furnish detailed statements showing amounts and quality of all products removed and sold, proceeds therefrom, and amount used for production purposes or unavoidably lost. Lessee may be required to provide plats and schematic diagrams showing development work and improvements, and reports with respect to parties in interest, expenditures, and depreciation costs. In the form prescribed by lessor, lessee shall keep a daily drilling record, a log, information on well surveys and tests, and a record of subsurface investigations and furnish copies to lessor when required. Lessee shall keep open at all reasonable times for inspection by any authorized officer of lessor, the leased premises and all wells, improvements, machinery, and fixtures thereon, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or in the leased lands. Lessee shall maintain copies of all contracts, sales agreements, accounting records, and documentation such as billings, invoices, or similar documentation that supports costs claimed as manufacturing, preparation, and/or transportation costs. All such records shall be maintained in lessee's accounting offices for future audit by lessor. Lessee shall maintain required records for 6 years after they are generated or, if an audit or investigation is underway, until released of the obligation to maintain such records by lessor.

During existence of this lease, information obtained under this section shall be closed to inspection by the public in accordance with the Freedom of Information Act (5 U.S.C. 552).

Sec. 6. Conduct of operations—Lessee shall conduct operations in a manner that minimizes adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users. Lessee shall take reasonable measures deemed necessary by lessor to accomplish the intent of this section. To the extent consistent with lease rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-way. Such uses shall be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessee.

Prior to disturbing the surface of the leased lands, lessee shall contact lessor to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short term special studies under guidelines provided by lessor. If in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee shall immediately contact lessor. Lessee shall cease any operations that would result in the destruction of such species or objects.

Sec. 7. Mining operations—To the extent that impacts from mining operations would be substantially different or greater than those associated with normal drilling operations, lessor reserves the right to deny approval of such operations.

Sec. 8. Extraction of helium—Lessor reserves the option of extracting or having extracted helium from gas production in a manner specified and by means provided by lessor at no expense or loss to lessee or owner of the gas. Lessee shall include in any contract of sale of gas the provisions of this section.

Sec. 9. Damages to property—Lessee shall pay lessor for damage to lessor's improvements, and shall save and hold lessor harmless from all claims for damage or harm to persons or property as a result of lease operations.

Sec. 10. Protection of diverse interests and equal opportunity—Lessee shall: pay when due all taxes legally assessed and levied under laws of the State or the United States; accord all employees complete freedom of purchase; pay all wages at least twice each month in lawful money of the United States; maintain a safe working environment in accordance with standard industry practices; and take measures necessary to protect the health and safety of the public.

Lessor reserves the right to ensure that production is sold at reasonable prices and to prevent monopoly. If lessee operates a pipeline, or owns controlling interest in a pipeline or a company operating a pipeline, which may be operated accessible to oil derived from these leased lands, lessee shall comply with section 28 of the Mineral Leasing Act of 1920.

Lessee shall comply with Executive Order No. 11246 of September 24, 1965, as amended, and regulations and relevant orders of the Secretary of Labor issued pursuant thereto. Neither lessee nor lessee's subcontractors shall maintain segregated facilities.

Sec. 11. Transfer of lease interests and relinquishment of lease—As required by regulations, lessee shall file with lessor any assignment or other transfer of an interest in this lease. Lessee may relinquish this lease or any legal subdivision by filing in the proper office a written relinquishment, which shall be effective as of the date of filing, subject to the continued obligation of the lessee and surety to pay all accrued rentals and royalties.

Sec. 12. Delivery of premises—At such time as all or portions of this lease are returned to lessor, lessee shall place affected wells in condition for suspension or abandonment, reclaim the land as specified by lessor and, within a reasonable period of time, remove equipment and improvements not deemed necessary by lessor for preservation of producible wells.

Sec. 13. Proceedings in case of default—If lessee fails to comply with any provisions of this lease, and the noncompliance continues for 30 days after written notice thereof, this lease shall be subject to cancellation unless or until the leasehold contains a well capable of production of oil or gas in paying quantities, or the lease is committed to an approved cooperative or unit plan or communitization agreement which contains a well capable of production of unitized substances in paying quantities. This provision shall not be construed to prevent the exercise by lessor of any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver shall not prevent later cancellation for the same default occurring at any other time. Lessee shall be subject to applicable provisions and penalties of FOGRMA (30 U.S.C. 1701).

Sec. 14. Heirs and successors-in-interest—Each obligation of this lease shall extend to and be binding upon, and every benefit hereof shall inure to the heirs, executors, administrators, successors, beneficiaries, or assignees of the respective parties hereto.

*U.S. GPO: 1992-774-017/67034

B. PREFERRED ALTERNATIVE E-7 MITIGATION MEASURES

Table D-1 displays the stipulations and lease notices that would be applied to the individual resources of concern listed for the leasing Alternative E-7. The complete descriptions of each stipulation and lease notice are included following this table. Forest Plan amendments for stipulations may be necessary in order to implement this alternative.

TABLE D-1

Stipulation and Lease Notice Summary For the Preferred Alternative E-7

RESOURCE	STIPULATION OR LEASE NOTICE	AREA/RATIONALE FOR THE MITIGATION OR LEASE NOTICE	PAGE
IRA	NSO	To maintain roadless character within Inventoried Roadless Areas	D-6
RNA	NSO	Prohibit activities within Research Natural Areas	D-6
SIA	NSO	Prohibit activities within Candidate Special Interest Areas	D-6
SIA	CSU	Minimize disturbance within Nominated Special Interest Areas	D-7
Wildlife	NSO	Within 100' of prairie dog towns	D-7
Wildlife	NSO	Within ½ mile of ferruginous hawk, golden eagle and prairie falcon nests	D-8
Wildlife	Timing	Within 1 mile of ferruginous hawk nests, March 1 through August 1	D-8
Wildlife	NSO	Prohibit activities within bighorn sheep habitat	D-9
Wildlife	NSO	Prohibit activities within ¼ mile of sage and sharptail grouse dancing grounds	D-9
Wildlife	Timing	Within 2 miles of sage grouse dancing grounds, March 1 through June 15	D-10
Wildlife	Timing	Within 1 mile of sharptail grouse dancing grounds, March 1 through June 15	D-10
Vegetation	CSU	Protect known sensitive and watch plant populations	D-11
Wildlife	NSO	Prohibit activities near isolated clay buttes within antelope winter range	D-11
Wildlife	Timing	Antelope winter range, January 1 through March 31	D-12
Wildlife	CSU	Minimize disturbance to mule deer habitat (canyonlands)	D-12
Vegetation	NSO	Protect ponderosa pine tree stands	D-13
Riparian	CSU	Minimize disturbance to riparian areas, including the aquatic and riparian ecosystems	D-13
Woody Draw	NSO	Minimize disturbance to woody draws	D-13
Visual	NSO	Within the foreground seen area of the Little Missouri River, including W&S issue	D-14
Visual	CSU	Remaining Little Missouri River seen areas, NFS access routes, and ponderosa pine	D-14
Recreation	NSO	Prohibit activities within Burning Coal Vein campground	D-15
Recreation	Timing	Within the foreground seen area of the Little Missouri River, including W&S issue	D-15
Recreation	Timing	Within ¼ mile of Burning Coal Vein campground from May 15 through December 1	D-16
Cultural	NSO	Protect traditional use areas	D-16
Paleontology	CSU	Protect paleontological resources in the Marmarth area	D-17
Steep slopes	NSO	Prohibit activities on slopes > 40% and/or on mass failure hazard areas	D-17
Lands	Lease Notice	NFS Lands under USDA Jurisdiction	D-19
Cultural	Lease Notice	Protect archeological sites	D-19
Paleontology	Lease Notice	Protect paleontological resources	D-19
Floodplains	Lease Notice	Minimize disturbance to riparian areas, including the aquatic and riparian ecosystems	D-19
T,E & S	Lease Notice	Protection of Threatened, Endangered and Sensitive species	D-20

1. Mitigation Measures

Following are the complete descriptions for each stipulation and Lease Notice that would be applied to the resources of concern listed for the leasing Alternative E-7. Also included with each stipulation description are the Forest Plan Management Standards that would apply to access and all off-drill-pad development and production related facilities, both on and off lease. These Management Standards are included here so that the intent of the overall management of all oil and gas activities on Federal mineral estates is clear.

INVENTORIED ROADLESS AREAS (IRAs) - NSO

Resource: Bullion Butte (L1DBJ), Kinley Plateau (L1DBI) and Strom Hanson (L1DBL) Inventoried Roadless Areas.

Stipulation: No surface occupancy or use is allowed within these IRAs.

Objective: To protect these areas from oil and gas development, and to maintain the existing roadless character (Forest Plan Amendment #xxx).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely.

Forest Plan: All access and other development and production related facilities will be prohibited.

RESEARCH NATURAL AREAS (RNAs) - NSO

Resource: Limber Pine (Management Area L)

Stipulation: No surface occupancy or use is allowed within the established boundaries of this RNA.

Objective: To protect against activities which directly or indirectly modify the natural occurring ecological processes with the RNA (Forest Plan, p. 78-79).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely.

Forest Plan: All access and other development and production related facilities will be prohibited.

CANDIDATE SPECIAL INTEREST AREAS (SIAs) - NSO

Resource: Black Cottonwood, Bullion Butte Escarpment, Burning Coal Vein, Pretty Butte, Black Butte, and Round Top Butte.

Stipulation: No surface occupancy or use is allowed within the proposed boundaries of these Candidate SIAs.

Objective: To protect against activities which directly or indirectly modify the natural occurring ecological processes with the Candidate SIAs (Forest Plan, p. 78-79).

Waiver: This stipulation may be waived for any of these Candidate SIAs if the pending RNA criteria analysis for them determines that they do not meet the RNA requirements. At that time, the appropriate stipulation and Forest Plan Management Standards will be determined.

Exception: No exceptions to this stipulation will be granted.

Modification: The boundaries of the stipulated areas may be modified for any of these Candidate SIAs if the pending RNA criteria analysis for them determines that portions of them do not meet the RNA requirements.

Forest Plan: All access and other development and production related facilities will be prohibited.

NOMINATED SPECIAL INTEREST AREAS (SIAs) - CSU

Resource: Bullion Creek Formation Type Section, Slope Formation Type Section, and the Cannonball/ Slope Formation outcrop.

Stipulation: Occupancy or use is subject to the following special operating constraints:

A pre-development survey for the area of the proposed surface disturbing activities will be conducted within the boundaries of these Nominated SIAs. Surface occupancy or use will be allowed if that survey determines that the proposed action will not disturb the geologic outcrops.

Objective: To protect against activities which directly or indirectly modify or destroy the geologic outcrops, in order to maintain them in a condition to allow continued geologic scientific research (Forest Plan Amendment #xxx).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely.

Forest Plan: All access and other development and production related facilities will be allowed under the conditions discussed above.

WILDLIFE - NSO

Resource: Prairie dog towns, which may include habitat for Threatened, Endangered or Sensitive species.

Stipulation: No surface occupancy or use is allowed within the boundaries of prairie dog towns, and within 100 feet of the boundaries of prairie dog towns.

Objective: To protect the integrity of prairie dog towns for predator and other species use (Forest Plan, p. 18, 46, 51, 55 and 59).

Waiver: This stipulation may be waived if the dog towns included within the leasehold are slated for control treatment.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting these prairie dog towns.

Forest Plan: All access and other development and production related facilities will be prohibited.

WILDLIFE - NSO

Resource: Ferruginous hawks, golden eagles and prairie falcons.

Stipulation: No surface occupancy or use is allowed within ½ mile (line of site) of ferruginous hawk, golden eagle and prairie falcon nest sites that have been active within the previous 5 years.

Objective: To maintain a ½ mile no disturbance zone for nests which have been active within the previous 5 years in order to maintain the production potential of ferruginous hawks, identified as Category 2 species under the Endangered Species Act, and for the protection of golden eagles and prairie falcons, listed as Key Species in the Custer Forest Plan (Forest Plan, p. 19, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that the nest site has been completely abandoned or destroyed.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting these raptors.

Forest Plan: All access and other development and production related facilities will be prohibited. Seasonal exceptions may be allowed for the construction of buried pipelines or powerlines from August 1 through March 1 (non breeding season) for Ferruginous hawks and prairie falcons, and from August 1 through February 1 (non breeding season) for golden eagles.

WILDLIFE - Timing

Resource: Ferruginous hawks.

Stipulation: No surface use is allowed within 1 mile (line of site) of ferruginous hawk nest sites, that have been active within the previous 5 years, during the following time period (this does not apply to the operation and maintenance of production facilities):

March 1 through August 1.

Objective: To minimize disturbances to ferruginous hawk nest sites during periods of breeding, incubation and fledgling, for nests that have been active within the previous 5 years, (Forest Plan, p. 19 and 46, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that the nest site has been completely abandoned or destroyed.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting these raptors.

Forest Plan: All development related activities, and the construction of all access and other development and production related facilities will be prohibited during this time period. This does not apply to the operation and maintenance of production facilities.

WILDLIFE - NSO

Resource: Bighorn sheep

Stipulation: No surface occupancy or use is allowed within bighorn sheep habitat.

Objective: To prohibit oil and gas activities within bighorn sheep habitat pending the outcome of the Moody Plateau Sheep study (bighorn sheep were identified as sensitive species). This area will be re-evaluated for leasing conditions when the sheep study is released in August, 1996 (Forest Plan Amendment #xxx).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely until after the Moody Plateau Sheep Study results have been adequately analyzed (report due in August, 1996). At that time, the authorized officer may grant WEMs based on the results of the analysis of the pending sheep study. Due to the major concerns expressed over this issue, waivers or modifications may require 30 day public review (43 CFR 3101.1-4).

Forest Plan: All access and other development and production related facilities will be prohibited. However, access to and use of the existing pipeline corridor across Moody Plateau will be permitted.

WILDLIFE - NSO

Resource: Sage and Sharptail grouse

Stipulation: No surface occupancy or use is allowed within ¼ mile of sage and sharptail grouse leks.

Objective: To prohibit disturbance within ¼ mile of grouse leks for the protection of sage grouse, listed as sensitive species, and sharptail grouse, listed as Management Indicator Species in the Custer Forest Plan (Forest Plan, p. 46 and 55, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that all leks within ¼ mile of the leasehold have not been used for 5 consecutive years.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting these leks.

Forest Plan: All access and other development and production related facilities will be prohibited.

WILDLIFE - Timing

Resource: Sage grouse

Stipulation: No surface use is allowed within 2 miles of sage grouse leks during the following time period (this does not apply to the operation and maintenance of production facilities):

March 1 through June 15.

Objective: To minimize ground disturbances within sage grouse nesting habitat during spring and early summer in order to maximize annual production of young, and to protect nesting activities adjacent to nesting sites for the long-term maintenance of sage grouse populations in the area (Forest Plan, p. 19, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that the entire lease-hold no longer contains sage grouse nesting habitat.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action avoids nest habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting nesting habitat.

Forest Plan: All development related activities, and the construction of all access and other development and production related facilities will be prohibited during this time period.

WILDLIFE - Timing

Resource: Sharptail grouse

Stipulation: No surface use is allowed within 1 mile of sharptail grouse leks during the following time period (this does not apply to the operation and maintenance of production facilities):

March 1 through June 15.

Objective: To minimize ground disturbances within sharptail grouse nesting habitat during spring and early summer in order to maximize annual production of young, and to protect nesting activities adjacent to nesting sites for the long-term maintenance of sharptail grouse populations in the area. (Forest Plan, p. 19, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that the entire lease-hold no longer contains sharptail grouse nesting habitat.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action avoids nest habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting nesting habitat.

Forest Plan: All development related activities, and the construction of all access and other development and production related facilities will be prohibited during this time period.

VEGETATION - CSU

Resource: Sensitive and Watch plant species

Stipulation: Surface occupancy or use is subject to the following operating constraints:

Occupancy and use may be allowed provided that no surface disturbance occurs within the site boundaries of known sensitive and watch plant species populations.

Objective: To protect known sensitive and watch plant species populations in order to prevent the species from becoming threatened or endangered (Forest Plan, p. 179 and 180).

Waiver: This stipulation may be waived if the authorized officer determines that there are no sensitive plant populations or habitat within the leasehold.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area do not include sensitive plant populations or habitat.

Forest Plan: All access and other development and production related facilities will be permitted under the conditions described above.

WILDLIFE - NSO

Resource: Isolated clay buttes within antelope winter range.

Stipulation: No surface occupancy or use is allowed within 900 feet of known isolated clay buttes within antelope winter range.

Objective: To prevent disturbance to thermal cover areas within antelope winter range. Antelope are listed as a Management Indicator Species (Forest Plan, p. 177-180, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains antelope winter habitat.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain antelope winter habitat.

Forest Plan: All access roads will be routed in order to minimize impacts to antelope winter range, avoiding those area described above. The location and installation of buried pipelines and powerlines will not require these restrictions provided that the construction activities for these facilities takes place from April 1 through December 31.

WILDLIFE - Timing

Resource: Antelope winter range.

Stipulation: No surface use is allowed during the following time period (this does not apply to the operation and maintenance of production facilities):

January 1 through March 31.

Objective: To minimize disturbance to antelope winter range. Antelope are listed as a Management Indicator Species (Forest Plan, p. 177-180, Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains antelope winter habitat.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain antelope winter habitat.

Forest Plan: All access roads will be routed in order to minimize impacts to antelope winter range, avoiding know isolated clay buttes. The location and installation of buried pipelines and powerlines will not require these restrictions provided that the construction activities for these facilities takes place between April 2 and December 31.

WILDLIFE - CSU

Resource: Mule deer habitat (canyonlands).

Stipulation: Surface occupancy or use is subject to the following operating constraints:

Operational constraints may include off-site production facilities, audio restrictions such as equipment mufflers, and gated access to minimize disturbance to key habitats for mule deer.

Objective: To minimize disturbance to areas known for their high value to mule deer, such as areas of valuable vegetative diversity and seclusion. Mule deer are listed as a Management Indicator Species (Forest Plan, p. 177-180, Forest Plan Amendment #xxx), and are associated with heads of canyons (Forest Plan, p. 47 and 55).

Waiver: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains mule deer habitat.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain mule deer habitat.

Forest Plan: All access roads will be routed in order to minimize impacts to mule deer habitat as described above.

VEGETATION - NSO

Resource: Ponderosa pine tree stands.

Stipulation: No surface occupancy or use is allowed within identified ponderosa pine tree stands.

Objective: To preserve the existing ponderosa tree stands, a unique occurrence in the Little Missouri National Grasslands (Forest Plan Amendment #xxx).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely.

Forest Plan: Road and other facilities will be located to avoid cutting the crown class dominant and co-dominant trees.

RIPARIAN - CSU

Resource: Riparian areas (Management Area M), including the aquatic ecosystem (riverbed, perennial stream/river channels, shorelines, floodplains, wetlands) and the riparian ecosystem (transition between the aquatic and adjacent terrestrial ecosystem, comprised of distinctive soil, and distinctive vegetative communities, usually within 100 feet of the aquatic ecosystem).

Stipulation: Surface occupancy and use is subject to the following operating constraints:

Avoid the location of drill pads within the aquatic ecosystem, and to avoid disturbance to the distinctive vegetative communities within the riparian ecosystem.

Objective: To protect the biological and hydrological features associated with riparian areas (Forest Plan Amendment #xxx, Forest Plan, p. 81).

Waiver: This stipulation may be waived if the authorized officer determines that there are no riparian areas within the leasehold.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area do not include riparian areas.

Forest Plan: Access and other development and production facilities will be allowed, provided that they cross the riparian areas at right angles and maintain the normal grade of the streams in order to minimize road length and/or impacts within these areas.

WOODY DRAWS - NSO

Resource: Woody draws (Management Area N).

Stipulation: No surface occupancy or use is allowed within these woody draw areas.

Objective: To provide healthy, self-perpetuating plant communities that will have optimum diversity and density of understory and overstory vegetation, and to minimize disturbances to the wildlife dependent upon this system (Forest Plan, p. 83-84, Forest Plan Amendment # 13).

Waiver: This stipulation may be waived if the authorized officer determines that there are no woody draws within the leasehold.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action can be adequately mitigated.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area do not include woody draws.

Forest Plan: Access and other development and production related facilities may be allowed provided that they cross these areas at right angles to minimize road length, and the number of crossings is minimized.

VISUALS - NSO

Resource: Foreground viewsheds along the Little Missouri River, and in consideration for the potential classification of the river under the Wild and Scenic Rivers Act.

Stipulation: No surface occupancy or use is allowed within ¼ mile of the high water mark on each bank of the river on Fee, State or Federal surface in order to access Federal minerals, nor on Federal surface within the foreground viewshed of the Little Missouri River beyond the ¼ mile corridor. This does not apply to drilling operations as these activities are of short duration (refer to **RECREATION - Timing** for this resource).

Objective: To meet the VQO of Retention in the foreground viewshed of the Little Missouri River (Forest Plan, p. 47, 50 and 55).

Waiver: This stipulation may be waived if the authorized officer determines that the VQOs for the viewsheds within the leasehold are to be changed to be less restrictive.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action meets the VQO of retention. Table D-2 was designed to provide **guidance** for the District personnel on meeting the VQOs for viewsheds.

On shallow slopes (less than approximately 15 per cent), occupancy may be allowed but strictly controlled. On steeper slopes (greater than 15 per cent) occupancy would be prohibited because the drill pad itself would not meet the VQO of retention.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area are not within the established viewsheds.

Forest Plan: Access routes and any above-ground development and production facilities will also be controlled as described above.

VISUALS - CSU

Resource: Middleground and background viewsheds along the Little Missouri River, foreground and middleground viewsheds along the major NFS lands access routes (State Highways 12 and 85, Forest Roads 767, 772, 782, 783, and Forest Highway 3), the Wildlife Viewing Route, and the foreground surrounding the Burning Coal Vein campground and the Ponderosa Pine area.

Stipulation: Surface occupancy or use is subject to the following operating constraints:

Operational constraints may include utilizing topographic/vegetative screening, matching color tones of facilities with the surrounding topographic features, orienting the well pad/ facilities to minimize size and movement, and using only standard size production facilities.

Objective: To meet the VQO of Retention for the middle and background viewsheds of the Little Missouri River. To meet the VQO of Partial Retention for the remaining viewsheds listed above (Forest Plan, p. 47 and 55).

Waiver: This stipulation may be waived if the authorized officer determines that the VQOs for the viewsheds within the leasehold are to be changed to be less restrictive.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action meets the VQOs. An exception may also be granted in those specified road corridors referred to in bighorn sheep habitat and Inventoried Roadless Areas where disturbance would be permitted.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area are not within the established viewsheds.

Forest Plan: Access routes and any above-ground development and production facilities will also be controlled as described above.

RECREATION - NSO

Resource: Within the established boundary of the Burning Coal Vein campground.

Stipulation: No surface occupancy or use is allowed within this area.

Objective: To maintain the recreation opportunities and settings within established campground (Forest Plan, p. 62).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely.

Forest Plan: All access and other development and production related facilities will be prohibited within this area.

RECREATION - Timing

Resource: Foreground viewsheds along the Little Missouri River, and in consideration for the potential classification of the river under the Wild and Scenic Rivers Act.

Stipulation: No surface use is allowed within ¼ mile of the high water mark on each bank of the river on Fee, State of Federal surface in order to access Federal minerals, nor on Federal surface within the foreground viewshed beyond the ¼ mile corridor of the Little Missouri River during the following time period (this does not apply to the operation and maintenance of production facilities - refer to **VISUALS - NSO** for this resource):

May 15 through September 15.

Objective: To maintain the dispersed recreation opportunities and settings within the foreground viewshed of the Little Missouri River (Forest Plan, p. 62).

Waiver: The current situation indicates that approval of a waiver to this stipulation would be unlikely.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action does not impact the recreation opportunity or setting of the Little Missouri River.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area are not within the viewshed of the river.

Forest Plan: Construction of all access and other development and production related facilities will be prohibited during this time period.

RECREATION - Timing

Resource: Within ¼ mile of the established boundary of the Burning Coal Vein campground.

Stipulation: No surface use is allowed during the following time period (this stipulation does not apply to operation and maintenance of production facilities):

May 1 through December 1.

Objective: To maintain the recreation opportunities and settings within the area surrounding campgrounds (Forest Plan, p. 62, and Forest Plan Amendment #xxx).

WEM: The current situation indicates that approval of a waiver to this stipulation would be unlikely.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action does not impact the recreation opportunity or setting of the campground.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area are not within ¼ mile of the campground.

Forest Plan: Construction of all access and other development and production related facilities will be prohibited during this time period.

CULTURAL - NSO

Resource: Traditional cultural properties.

Stipulation: No surface occupancy or use is allowed within these areas.

Objective: To provide maximum protection required for these traditional cultural use properties (Forest Plan, p. 14-16).

WEM: The current situation indicates that approval of a waiver, exception or modification would be unlikely.

Forest Plan: All access and other development and production related activities will be prohibited.

PALEONTOLOGY - CSU

Resource: Within the designated area near Marmarth, outcrops of Cretaceous, Tertiary, and the "KT Boundary" (contact between these two geologic formations).

Stipulation: Surface occupancy or use is subject to the following operating constraints:

A pre-development survey for the area of the proposed surface disturbing activities will be conducted by a qualified geologist, as approved by the Custer National Forest, to determine the presence of paleontological resources which will be avoided. Surface occupancy or use will be allowed if that survey determines that the proposed action will not disturb any paleontological resources.

Objective: To prevent the loss of paleontological resources (Forest Plan Amendment #xxx).

Waiver: This stipulation may be waived if the authorized officer determines that there are no paleontological resources within the leasehold.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not impact these resources.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area do not contain these geologic formations.

Forest Plan: All access and other development and production related facilities will be controlled as described above (Forest Plan Amendment #xxx).

STEEP SLOPES - NSO

Resource: Slopes greater than 40 per cent, and areas of mass failure hazard.

Stipulation: No surface occupancy or use is allowed within these areas.

Objective: To protect soil resources from loss of productivity, and of water to prevent increased sedimentation due to failures of the overlying slopes (Forest Plan, p. 46, 47, 51, 55 and 59).

Waiver: This stipulation may be waived if the authorized officer determines that there are no steep slopes within the leasehold.

Exception: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not impact the integrity of steep slopes.

Modification: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area do not contain steep slopes.

Forest Plan: All access and other development and production related facilities will be prohibited. Exceptions may be made for short distances, i.e. ¼ mile or less, where this will minimize the total impacts to the area.

C. LEASE NOTICES

The following Lease Notices are proposed to be included on all leases:

1. Notice for Lands of the National Forest System under Jurisdiction of the Department of Agriculture.

2. Cultural and Paleontological Resources.

Authorities: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places. Section 6 of the Oil and Gas Lease Terms (Form 3100-11) requires that operations be conducted in a manner that minimizes adverse impacts to cultural and other resources. Other authority includes the Forest Plan as required by the National Forest Management Act of 1976.

3. Floodplain and Wetlands.

Authorities: Executive Order 11990 - Protection of Wetlands, Executive Order 11988 - Floodplain Management, 36 CFR 219.23, 36 CFR 219.27(e), and the Forest Plan as required by the National Forest Management Act of 1976.

4. Threatened, Endangered, and Sensitive Plant or Animal Species.

This lease notice will only apply to all Federal minerals. The threatened and endangered species encountered during oil and gas operations on Federal leases will be protected according to the provisions of the Endangered Species Act of 1973. The Forest Service and BLM have incorporated sensitive species policies in their management of Federal lands, however, the BLM policy is different in scope, content and application than the Forest Service policy.

Authorities: Endangered Species Act of 1973 (as amended), Section 6 of the Oil and Gas Lease Terms (Form 3100-11), 50 CFR 402, 36 CFR 219.19, and 36 CFR 219.26, and the Forest Plan as required by the National Forest Management Act of 1976.

These Lease Notices are displayed on the following pages.

Serial No. _____

FS Parcel No.

NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE

The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of an exploration plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by an exploration plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

District Ranger, Medora Ranger District, Custer National Forest
Route 3, Box 131-B
Dickinson, ND 58601

who is the authorized representative of the Secretary of Agriculture.

CULTURAL AND PALEONTOLOGICAL RESOURCES - The FS is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS, shall:

1. Contact the FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:

2. Engage the services of a cultural resource specialist acceptable to the FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the FS for review and approval at the time a surface disturbing plan of operation is submitted.

3. Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

FLOODPLAIN AND WETLANDS - The lessee is hereby notified that this lease may contain land within a riparian ecosystem (Management Area M, Custer Forest Plan, page 80). All activities within this area may be highly restricted in order to comply with Executive Order 11988 - *Floodplain Management* and Executive Order 11990 - *Protection of Wetlands*, in order to preserve and restore or enhance the natural and beneficial values served by floodplains and wetlands.

Management Area M, the riparian ecosystem, will be managed by the Forest Service to protect from conflicting uses in order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation. Occupancy and use of lands within Management Area M proposed in a Surface Use Plan of Operations will be considered in an environmental analysis done to identify the mitigation measures necessary to protect the riparian area. Special measures such as road design, well pad size and location or directional drilling, may be made part of the permit authorizing the activity.

Parcel No.

Serial No._____

USDA - FOREST SERVICE

THREATENED, ENDANGERED, AND SENSITIVE PLANT OR ANIMAL SPECIES LEASE NOTICE

The lease area may contain threatened and endangered species or habitat necessary for the continued existence of threatened, proposed and endangered species which are protected by the 1973 Endangered Species Act, as amended (50 CFR 402). The lease area may also contain habitat or species, listed as sensitive, which may require protective measures to prevent them from being listed as threatened or endangered or result in a loss of viability or biological diversity (36 CFR 219.19 or 219.26). A biological evaluation of the leased lands may be required prior to surface disturbance to determine if threatened, endangered, or sensitive plant or animal species or their habitat are present and to identify needed mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator shall:

1. Contact the Forest Service to determine if a biological evaluation is required (FSM 2670.31-32). The Forest Service is responsible for ensuring that the leased land is examined through a biological evaluation, prior to undertaking any surface-disturbing activities, to determine effects upon any plant or animal species listed or proposed for listing as threatened, endangered, or sensitive.

2. The lessee or operator may choose to conduct the evaluation on the leased lands at their discretion and cost. This biological evaluation must be done by or under the supervision of a qualified biologist/botanist approved by the Forest Service. An acceptable report must be provided to the Forest Service identifying the anticipated effects of a proposed action on threatened, endangered, or sensitive species. An acceptable biological evaluation is to be submitted to the Forest Service for review and approval no later than that time when an otherwise complete application for approval of drilling or subsequent surface-disturbing operation is submitted.

3. Implement mitigation measures required by the Forest Service. Mitigation may include the relocation of proposed lease-related activities or other protective measures. The findings of the biological evaluation may result in some restrictions to the operator's plans or even disallow use and occupancy to comply with the 1973 Endangered Species Act (as amended), threatened and endangered regulations and Forest Service regulations.

If threatened, endangered, or sensitive plant or animal species are discovered in the area after any required biological evaluation has concluded, an evaluation will be conducted to assess the effect of ongoing and proposed activities. Based on the conclusion drawn in the evaluation, additional restrictions or prohibitions may be imposed to protect the species or their habitats.

D. VISUAL RESOURCE MANAGEMENT GUIDANCE

Table D-2 displays the recommended mitigation measures that may be incorporated by the Responsible Official at the APD stage of oil and gas development in order to meet the Visual Quality Objectives for the area of the proposed disturbance. The objective is to tune up to the best possible site development, given location, site characteristics and points of view. Emphasis is to reduce apparent size of oil well development forms - specifically earthwork and the facilities of pumps, tanks and sheds (the dominate visual elements). With any site development proposal, assessment of the situation is necessary so that the site development purpose is individually integrated to the specific location, minimizing the scenic impact of oil field development. The general guidance provided in this table is based on physical viewing situation premises. The premises identify physical dimensions and their relationships, and compare lower visibility situations with higher visibility situations. Individual proposals can be assessed for their visual attributes using the premises and this table.

The oil production phase elements are listed in order of their visibility. For example, the earthwork for a pad has a higher degree of visibility than the tanks or sheds. Furthermore, earthwork is more visible on steep slopes than shallow ones.

The table's development is based on the following premises (Litton, 1984, Table 2, Figure 12, 13, and 14.):

1. Degrees of steepness (slope) and surface visibilities related to steepness and angles of view, and

2. Perspective foreshortening, reducing the apparent size of surfaces and objects when seen obliquely.

• Slope Steepness and Surface Visibilities

The steeper a slope, the greater is its proportion of visible surface. Therefore, to be minimally visible, site development should occur on the gentlest slopes. Steeper slopes increase the amount of earth moved and additionally increase visibility. The steeper middle of landforms should be avoided. Earthwork for roads and pads should parallel contours and repeat the landform's eroding surface pattern. Gentler slopes have higher revegetation potential. Southwest aspects have lower revegetation potential.

Steepness and surface visibilities (normal line of sight):

Per cent slope	Per cent of visible surface	Comments
10	10	
20	22	Range good for meeting VQO of partial retention
30	31	
40	38	Range good for meeting VQO of modification

• Facility Visibilities

This data applies directly to both site development and facilities installed at the site. Researchers indicate that the average person with 20/20 vision can distinguish detail down to "one square minute of arc" (Selkurt, 1961; Riggs, 1971]. [Eward Selkurt, *Physiology*, Brown & Little & Brown. Riggs, "Vision", Vol. 14, McGraw Hill Encyclopedia of Science and Technology, 1971). In 1884, Maertens determined that an object cannot be seen at distances greater than 3450 times its size. As an example, a black one and a half foot briefcase would be visible, and just distinguishable, on a snowy mountainside at a distance of one mile. It follows then that a twelve foot diameter, barrel shaped, tank is distinguishable at eight miles distance. Reduction of color and texture contrasts would reduce apparent visibility.

To minimize visibility, pad (with associated earthwork) should be parallel to line of sight projected from a view point. Roads should be installed on lower grades and, taking advantage of perspective foreshortening, should traverse slopes angled away from points of view. The pump jack, tank battery, treater tank and shed should be very close to end views to minimize visibility.

Alignment to points of view of surface slopes - object or group of objects:

Alignment (in degrees)	Per cent of apparent width	Comments
90 (end view)	Lowest per cent apparent width	Meets VQO of Retention
75	26	Meets VQO of Partial Retention
60	48	Meets VQO of Modification
45	70	Does not meet VQOs
30	89	Does not meet VQOs
0 (head-on)	100	Does not meet VQOs, the highest visibility

- **Landform Location**

Different locations on landforms can be expected to have higher visibility - the edges of skylines, terrain ridges, water edges (river or lake shore), and the areas of steeper middle landform slopes. Midslopes have the highest proportions of visible surface. The worst case would be when a high slope is perpendicular to the line of sight and facilities are located for head-on viewing.

When viewing repeating patterns of similar ridges, deviations of natural surface textures become more visible and apparent. Changes in patterns of vegetation and soil are the color and textural changes that are visually remarkable. The strongest color hue and value contrasts occur on skylines. Reducing color and texture contrasts in earthwork and facilities reduces the development's visibility. After earthwork, color and texture of residual soil surfaces sometimes need treatment that copies existing backdrop characteristics; the soil texture may be smooth, or it may be coarse. For example, scoria might be used on cut/fill slopes as well as road wearing surfaces when scoria is present in a backdrop. Facilities should be color coated and have a mottled color and varying surface texture rather than smooth, continually reflective surfaces. Colors should be present in the landscape or be of the same value in grey. Texture treatments could include the use of materials such as embossed, corrugated sheathing. Low visibility fencing could be typical colored steel posts and wire.

Reference: **Litton, R. Burton, Jr., 1984.** Visual Vulnerability of the Landscape: Control of Visual Quality, Research Paper WO-39, USDA, Forest Service.

TABLE D-2

Visual Resource Management Guidance Elements for Mitigation Measures to Meet Visual Quality Objectives (VQO)

VQO's→	RETENTION						PARTIAL RETENTION				MOD.*
PRODUCTION PHASE ELEMENTS	FOREGROUND 0 - ½ Mile		MIDDLEGROUND ½ - 3 Miles		BACKGROUND 3 - 5 Miles		FORE-GROUND 0 - ½ Mile	MIDDLEGROUND ½ - 3 Miles		BKGRND 3 - 5 Miles	ALL
in Order of Visibility ↓	SLOPES <15%	SLOPES 15% - 40%	SLOPES <15%	SLOPES 15% - 40%	SLOPES <15%	SLOPES 15% - 40%	SLOPES <40%	SLOPES <15%	SLOPES 15% - 40%	SLOPES <40%	SLOPES <40%
DRILL PAD	CSU	NSO	CSU	NSO	CSU	NSO	CSU	CSU	CSU	SLT	SLT
ACCESS ROAD	Low grade, traversing slope, subterrain base	Located outside viewshed	Low grade, traversing slope, subterrain base	Located outside viewshed	Low grade, traversing slope, subterrain base	Located outside viewshed	Low grade, traversing slope, subterrain base	Low grade, traversing slope, subterrain base	Low grade, traversing slope, subterrain base	SLT	SLT
TANKS	Offsite [1]	N/A	Offsite [1]	N/A	Color coated, aligned for end view	N/A	1 tank, or offsite [1]	Color coated, aligned for end view	Offsite [1]	SLT	SLT
HEATER/ TREATER TANK AND SHED	Offsite, or installed horizontal, aligned for end view	N/A	Offsite, or installed horizontal, aligned for end view	N/A	Color coated, aligned for end view	N/A	Offsite, or installed horizontal, aligned for end view	Color coated, aligned for end view	Offsite, or installed horizontal, aligned for end view	SLT	SLT
PUMP	Low Visibility Production Method [2]	N/A	Low Visibility Production Method [2]	N/A	Conventional method, aligned for end view	N/A	Low Visibility Production Method [2]	Conventional method, aligned for end view	Low Visibility Production Method [2]	SLT	SLT
ELECTRIC POWER	Buried in road corridor	Located outside viewshed	Buried in road corridor	Located outside viewshed	Buried in road corridor	Located outside viewshed	Buried in road corridor	Buried in road corridor	Buried in road corridor	SLT	SLT

* MODIFICATION

[1] If off lease, requires BLM approval.

[2] Can require submersible or vertical (Rolo-Flex) pump, special coloring.

N/A = Not Applicable

APPENDIX E

OIL AND GAS ACTIVITY SCENARIO

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX E

INTRODUCTION

This Appendix discusses the Oil and Gas Activity Scenario, which consists of three separate documents:

1. The Reasonably Foreseeable Development (RFD) Scenario, which estimates the level of oil and gas development and production to be expected in the project area over the next 10 to 15 years, produced by the BLM;

2. The Geology and Mineral Potential of the Williston Basin, in support of the RFD, produced by the BLM, and;

3. The Methodology for Producing the RFD Map of Hypothetical Well Locations, the process used to produce a map of hypothetical well sites for the purpose of site specific analysis, produced by the Forest Service.

Each document contains its own figures, maps and supportive references.

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO FOR OIL AND GAS SOUTHERN LITTLE MISSOURI NATIONAL GRASSLANDS CEDAR RIVER NATIONAL GRASSLANDS

Lee H. Jefferis
July 21, 1992
Revised March 26, 1993
Revised March 13, 1995

A. RFD INTRODUCTION

This section describes a reasonably foreseeable development scenario for the Southern Little Missouri National Grassland (SLMNG) and Cedar River National Grassland (CRNG) study areas (Figure 1) for the coming 10 to 15 years. Projected exploration and development activities are based on (1) historic trends for the southern Williston Basin, and (2) estimates of remaining undiscovered petroleum resources, which rely on the work of Fisher and others (1991), Heck (1990b), Long (1991), and Peterson (1988).

Amoco Production Company's *Crude Oil Price Bulletin* for North Dakota Fryburg-Medora (flat price) crude oil shows the oil price ranged from a low of $9.85 per barrel in 1986 to a high of $39.50 per barrel in 1980. We expect similar oil price fluctuations over the next ten to fifteen years. Increased oil and gas exploration and development is generally associated with periods of higher oil prices. This RFD anticipates that oil prices and associated exploration and development activities in the SLMNG will be similar to what has occurred over the past ten to fifteen years.

The potential for **occurrence** of oil and gas in the SLMNG and CRNG is shown on Figures 2 and 3. Potential reservoirs, listed in descending stratigraphic order, are as follows: (SLMNG) the Tyler Formation (Pennsylvanian), the Madison Group (Mississippian), and (SLMNG and CRNG) Red River Formation (Ordovician) (Figure 4). These qualitative estimates are defined as follows:

High Potential: The demonstrated presence of a mature source bed, suitable reservoir strata (containing adequate porosity and permeability), and traps into which petroleum has migrated.

Moderate Potential: The inferred presence of a mature source bed, suitable reservoir strata, migration pathways, and traps with a hydrocarbon charge.

Low Potential: The inference that a mature source bed, suitable reservoir strata, migration pathways, or charged traps may not be present.

The potential for **development** of petroleum resources is regarded as low to high for the SLMNG--the areas of development potential coincide with those of occurrence potential--and low for CRNG.

B. HISTORICAL TRENDS

1. LEASING

SLMNG - As of December 31, 1994, approximately 65,265 acres are under lease. It is estimated that 25% of the Federal O&G mineral estate in the SLMNG is currently under lease, as projected from information for Slope County.

CRNG - One Federal oil and gas lease, totaling approximately 640 acres is in effect within the Cedar River National Grassland study area.

2. SEISMIC DATA ACQUISITION

SLMNG - Permits have been issued for 30 miles of seismic lines since 1987; records are sketchy prior to that time. Forest Service officials report that several miles were shot during the drilling boom of the late 1970s and early 1980s.

CRNG - No permits have been issued for seismic activity since 1984 and no records are available for activity prior to that time.

3. DRILLING ACTIVITIES

SLMNG - As of December 31, 1992, 204 oil and gas test holes had been drilled resulting in the discovery of 11 fields (embracing 13 separate pools). Approximately 40% of the tests (80) were drilled in the past 15 years. Results of drilling are summarized in Tables 1-4.

CRNG - Seven test holes (all completed as dry holes) have been drilled in the 15-township area within and surrounding the study area; only two of the seven were drilled during the past 15 years.

4. PRODUCTION

SLMNG - Cumulative production through 1992 amounted to approximately eight million barrels of oil (MMBO) (see Table 5); production of an additional seven to nine million barrels is anticipated prior to reaching the expected ultimate recovery for the study area (Fisher and others, 1991, and BLM projections for recent discoveries).

CRNG - There is no established production in CRNG.

C. PROJECTED ACTIVITIES

1. DRILLING ACTIVITIES

SLMNG - Ninety to one hundred thirty additional oil and gas test holes are projected over the next ten to fifteen years. This includes development drilling of the Tracy Mountain-Moody Plateau area (60-70 tests), new-field wildcats throughout the study area (20-30 tests), and development drilling subsequent to any discoveries (10-30 tests).

CRNG - Two additional wells are projected over the next ten to fifteen years.

2. DISCOVERIES

SLMNG - It is projected that three new fields will be discovered due to wildcat drilling: one Tyler Field (5 MMBO), one Madison Field (1 MMBO), and one Red River Field (1 MMBO).

CRNG - No discoveries are anticipated for this study area over the next ten to fifteen years.

3. PRODUCTION

SLMNG - It is anticipated that an additional 7 MMBO will be discovered through the projected exploration and development activities.

CRNG - No additional reserves are anticipated.

D. SURFACE ACTIVITY FORECAST

Exploration and development activities usually consist of geophysical exploration followed by the construction of roads, drill pads, and possibly powerlines, storage tank batteries, and pipelines. When a commercial petroleum accumulation is developed, the area dedicated to production may be set aside for three to twenty years.

Roads permit access for ongoing operations and maintenance; construction is appropriate to the type and frequency of traffic expected. Roads leading to well sites that are subsequently abandoned are usually closed and reclaimed, though some may be retained and incorporated into the Ranger District's transportation plan.

Each well site requires construction of a level pad of two to five acres, which serves as a staging area for erecting the rig, building a reserve pit, and locating storage tanks and other equipment/installations necessary for drilling. Crew quarters may be temporarily located on the pad. When the well is completed, portions of the pad not required for ongoing operations are re-contoured and re-vegetated. If the well is plugged and abandoned, the entire pad is reclaimed. In some cases, new wells may be drilled from existing pads.

Electrical power for well-site operations may be provided by powerline or an on-site diesel generator. Wells in outlying areas may begin with on-site electrical generation and tie into existing powerline systems as the field is developed; new powerlines are routinely routed along existing road corridors.

Produced natural gas and/or hydrogen sulfide gas is piped to a central collection system, re-injected into the producing formation, or flared (burned) on-site. Flaring is often authorized while the well is being completed and until a pipeline can be connected. Produced water is normally piped to on-site tank batteries for storage prior to removal by truck, or is re-injected into underground saltwater reservoirs.

E. SUMMARY

SLMNG: It is expected that 90-130 oil and gas test holes will be drilled in the study area over the next 10-15 years: 20-30 new-field wildcats and 70-100 development wells. Wildcat drilling--with an expected discovery rate around 1/10--is expected to turn up three new fields (one each from the Tyler, and Red River Formations and one from the Madison Group) with combined reserves of approximately 7 MMBO. Normal spacing for the wells is 160 acres (320 acres for Red River wells). Expected sizes for typical fields are as follows: **Tyler field (5 MMBO)**: 10-25 wells covering 1600-4000 acres; **Madison field (1 MMBO):** 1-3 wells covering 160-480 acres; **Red River field (1 MMBO)**: 1-2 wells covering 320-640 acres. The total number of new producing wells expected is 50-75, many of which are anticipated in the Tracy Mountain-Moody Plateau area of Fryburg Field.

CRNG: It is expected that two oil and gas test holes will be drilled in the study area over the next 10-15 years, both of which would be new-field wildcats. The drilling is not expected to discover any new accumulations. The total number of producing wells expected is zero.

REFERENCES

Fisher, D.W., LeFever, J.A., Heck, T.J., and LeFever, R.D., 1991, Petroleum Potential of the Little Missouri National Grasslands: North Dakota Geological Survey Report of Investigation 91, 52 p.

Heck, T. J., 1990a, Oil Exploration and Development in the North Dakota Williston Basin: 1988-1989 Update: North Dakota Geological Survey Miscellaneous Series 74, 22p.

Heck, T.J., 1990b, Petroleum Potential of the Little Missouri National Grassland: North Dakota Geological Survey Contract Reports to U.S.D.A./Forest Service, Numbers 40-0343-9-7031 and 40-0343-0-7019.

Long, G.I.W., 1991, Occurrence and Development Potential Maps with accompanying Narrative for Cedar River National Grassland, Sioux and Grant Counties, North Dakota: U.S.D.I. B.L.M. unpublished report, 3p.

Peterson, J.A., 1988, Geologic Summary and Hydrocarbon Plays, Williston Basin, Montana, North and South Dakota, and Sioux Arch, South Dakota and Nebraska, U.S.: U. S. Geological Survey Open-File Report 87-450-N, 43p.

TABLE E-1

Drilling History: Southern Little Missouri Grassland
All Wells and Formations, 1955-1992.

INITIAL CLASS	FINAL CLASS		
	Dry	Producer	Total
Exploratory Wells (wildcats)			
Number of wells	97	11	108
% Exploratory wells	90%	10%	100%
Development Wells			
Number of wells	51	45	96
% Development wells	53%	47%	100%
Total Wells			
Number of wells	148	56	204
% of total wells	73%	27%	100%
Exploratory as % of all Wells	48%	5%	53%
Development as % of all Wells	25%	22%	47%

TABLE E-2

Drilling History: Southern Little Missouri Grassland
Tyler Formation, 1955-1992.

INITIAL CLASS	FINAL CLASS		
	Dry	Producer	Total
Exploratory Wells (wildcats)			
Number of wells	17	2	19
% Exploratory wells	89%	11%	100%
Development Wells			
Number of wells	41	36	77
% Development wells	53%	47%	100%
Total Wells			
Number of wells	58	38	96
% of total wells	60%	40%	100%
Exploratory as % of all Wells	18%	2%	20%
Development as % of all Wells	43%	38%	80%

TABLE E-3

Drilling History: Southern Little Missouri Grassland Madison Formation, 1955-1992.

INITIAL CLASS	FINAL CLASS		
	Dry	Producer	Total
Exploratory Wells (wildcats)			
Number of wells	26	2	29
% Exploratory wells	93%	7%	100%
Development Wells			
Number of wells	6	8	14
% Development wells	43%	57%	100%
Total Wells			
Number of wells	32	10	42
% of total wells	76%	24%	100%
Exploratory as % of all Wells	62%	5%	67%
Development as % of all Wells	14%	19%	33%

TABLE E-4

Drilling History: Southern Little Missouri Grassland Red River Formation, 1955-1992.

INITIAL CLASS	FINAL CLASS		
	Dry	Producer	Total
Exploratory Wells (wildcats)			
Number of wells	32	7	39
% Exploratory wells	82%	18%	100%
Development Wells			
Number of wells	4	1	5
% Development wells	80%	20%	100%
Total Wells			
Number of wells	36	8	44
% of total wells	82%	18%	100%
Exploratory as % of all Wells	73%	16%	89%
Development as % of all Wells	9%	2%	11%

TABLE E-5

Producing Fields, Southern Grassland Study Area.

Field Name Discovery Date Expected Lifetime	Estimated Ultimate Recovery Cumulative Production (1992) (MBO)	# Producing Wells When Fully Developed At Present
Red River Fields Amidon 1974 3 years (abd 1977)	 15 15	 1 0
Bull Run 1980 20 years	880 577	2 1
Cannonball 1983 9 years (abd 1992)	130 76	1 1
Cash 1982 13 years	242 168	1 1
Eleven Bar 1966 21 years (abd 1987)	665 665	2 0
Marmarth 1980 5 years (abd 1985)	37 37	1 0
Second Creek 1977 3 years (abd 1980)	9 9	1 0
Madison Fields Bull Run 1980 1 year (abd 1981)	 15 15	 1 0
Davis Creek 1987 17 years	472 145	3 3
Norwegian Creek 1976 9 years (abd 1985)	34 34	2 0
Rocky Ridge 1972 unknown (pre-1980)	46 46	1 0
Tyler Fields Tracey Mountain 1986 unknown lifetime	8,000 - 10,000 1,093	? 22
Rocky Ridge 1957 47 years	5,330 5,183	18 2

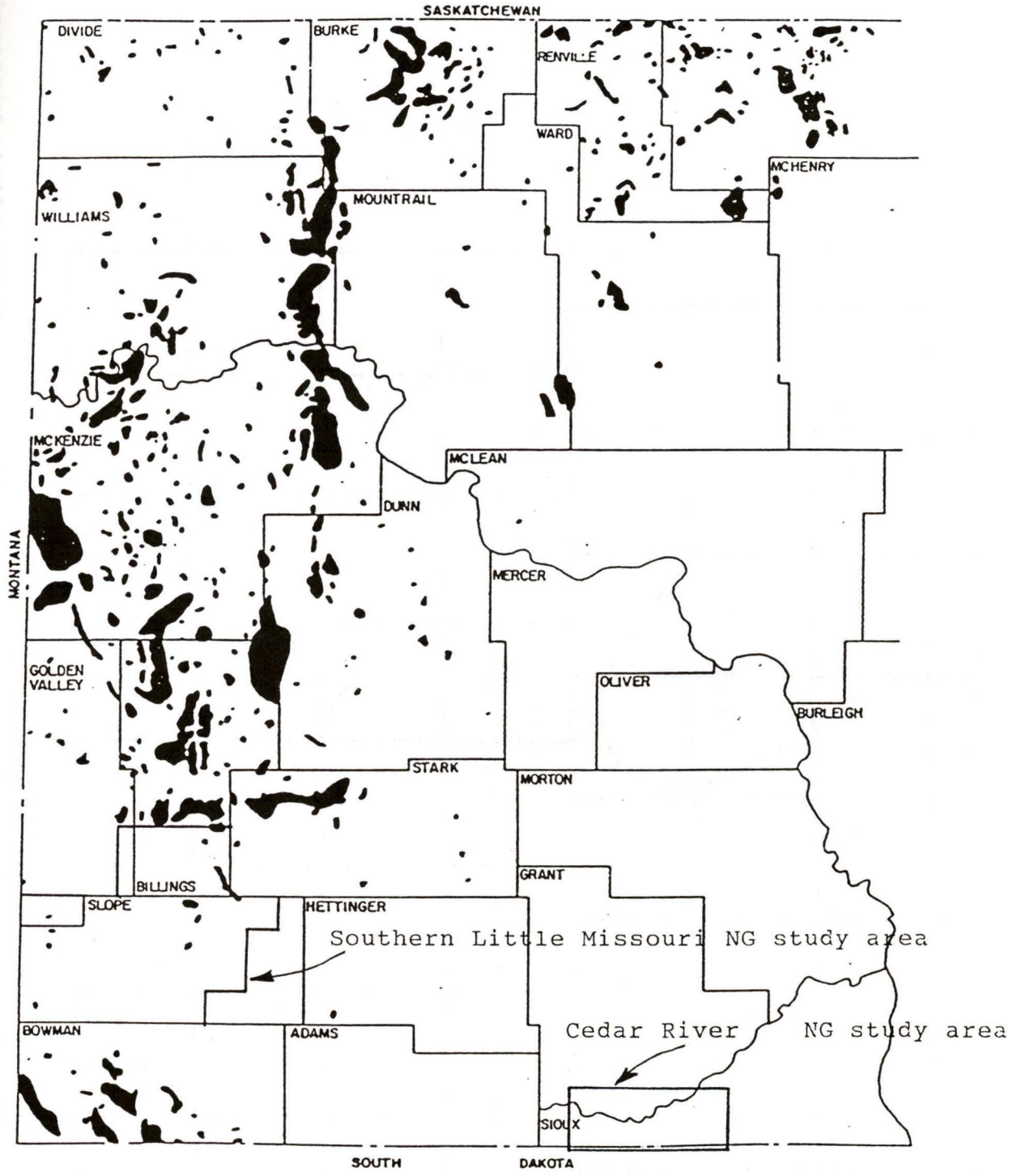


Figure 1. Map of western North Dakota with the approximate extent of all known oil fields at the end of 1989. Modified from Heck, 1990a.

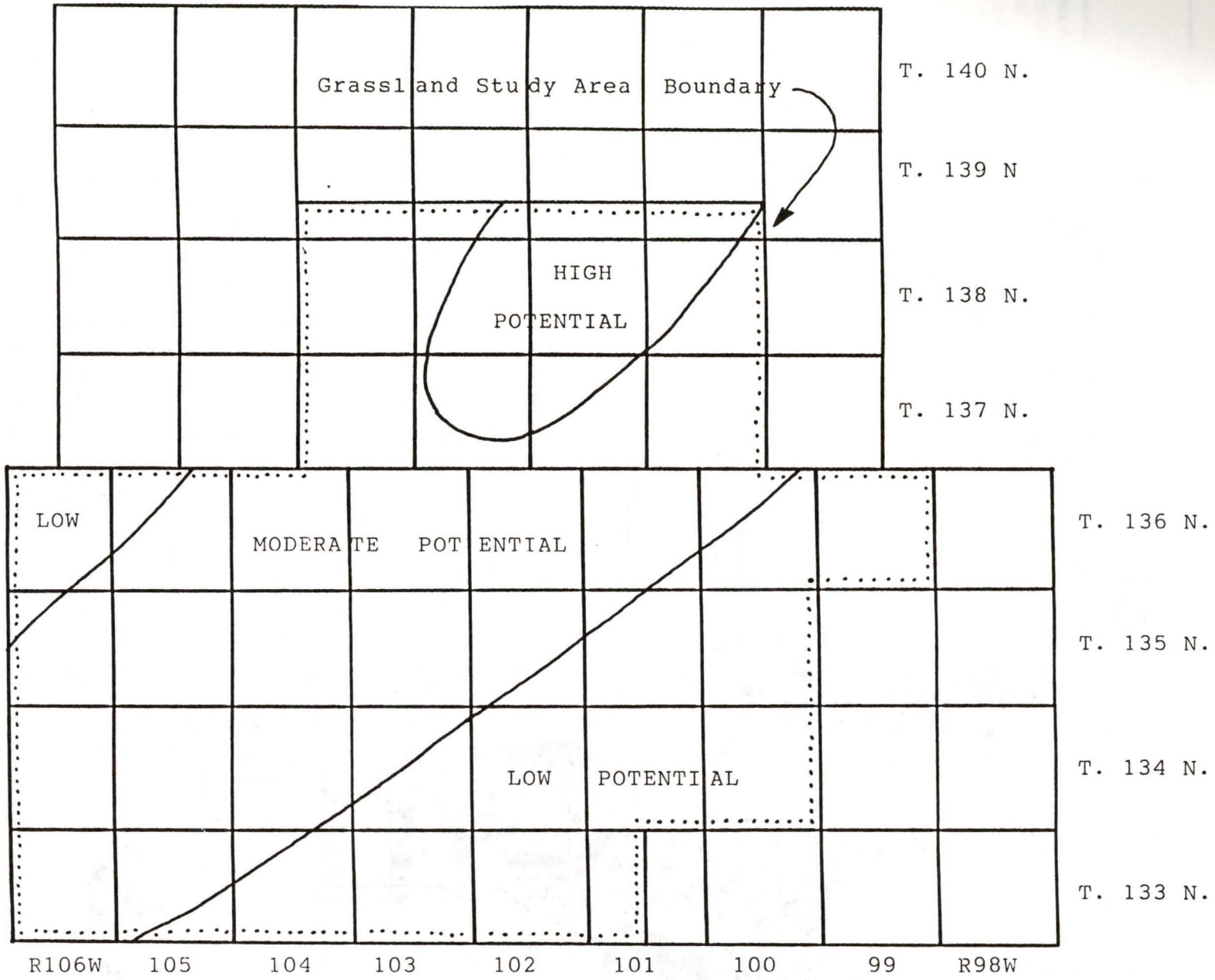


Figure 2. Potential for occurrence of oil and gas for the Southern LIttle Missouri National Grassland.

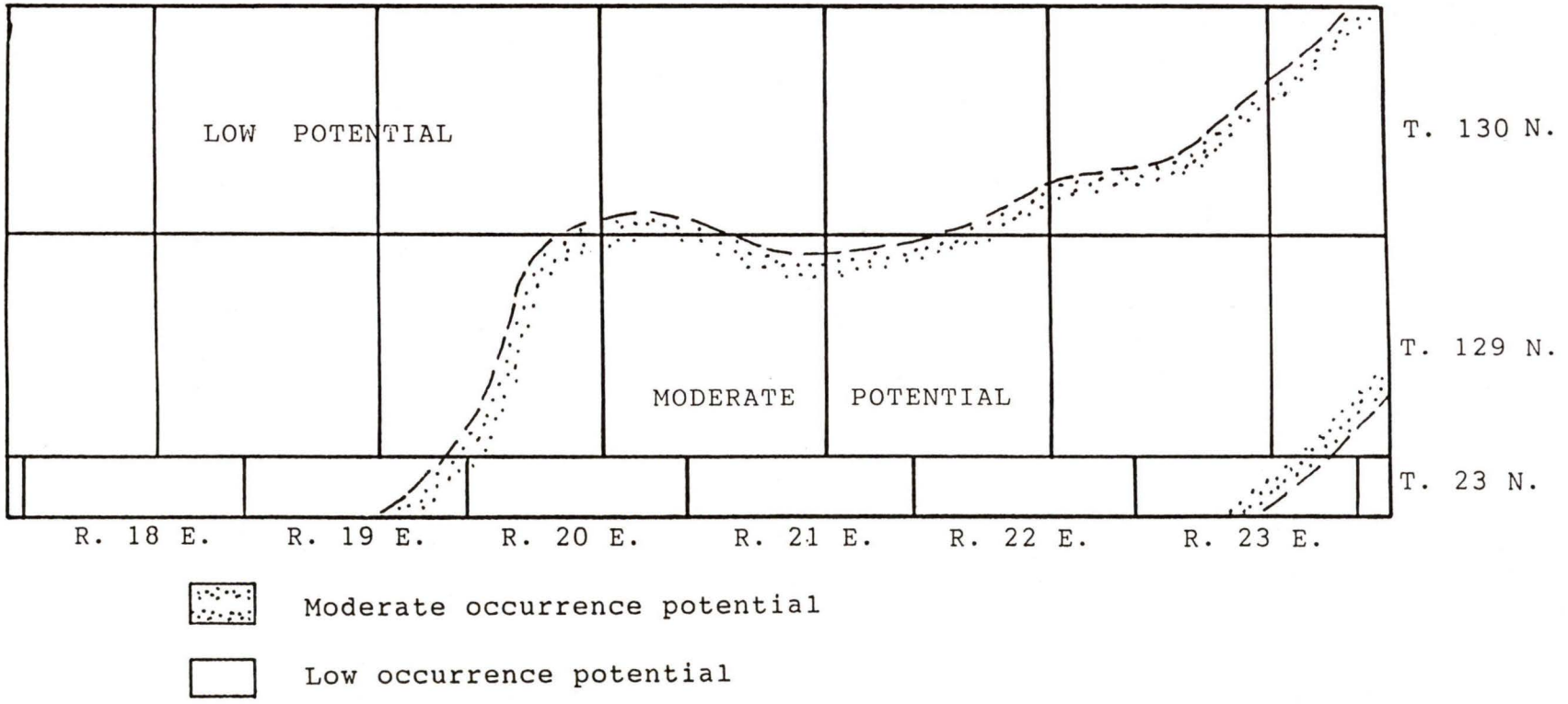


Figure 3. Potential for occurrence of oil and gas for the Cedar River National Grasslands.

NORTH DAKOTA

STRATIGRAPHIC COLUMN

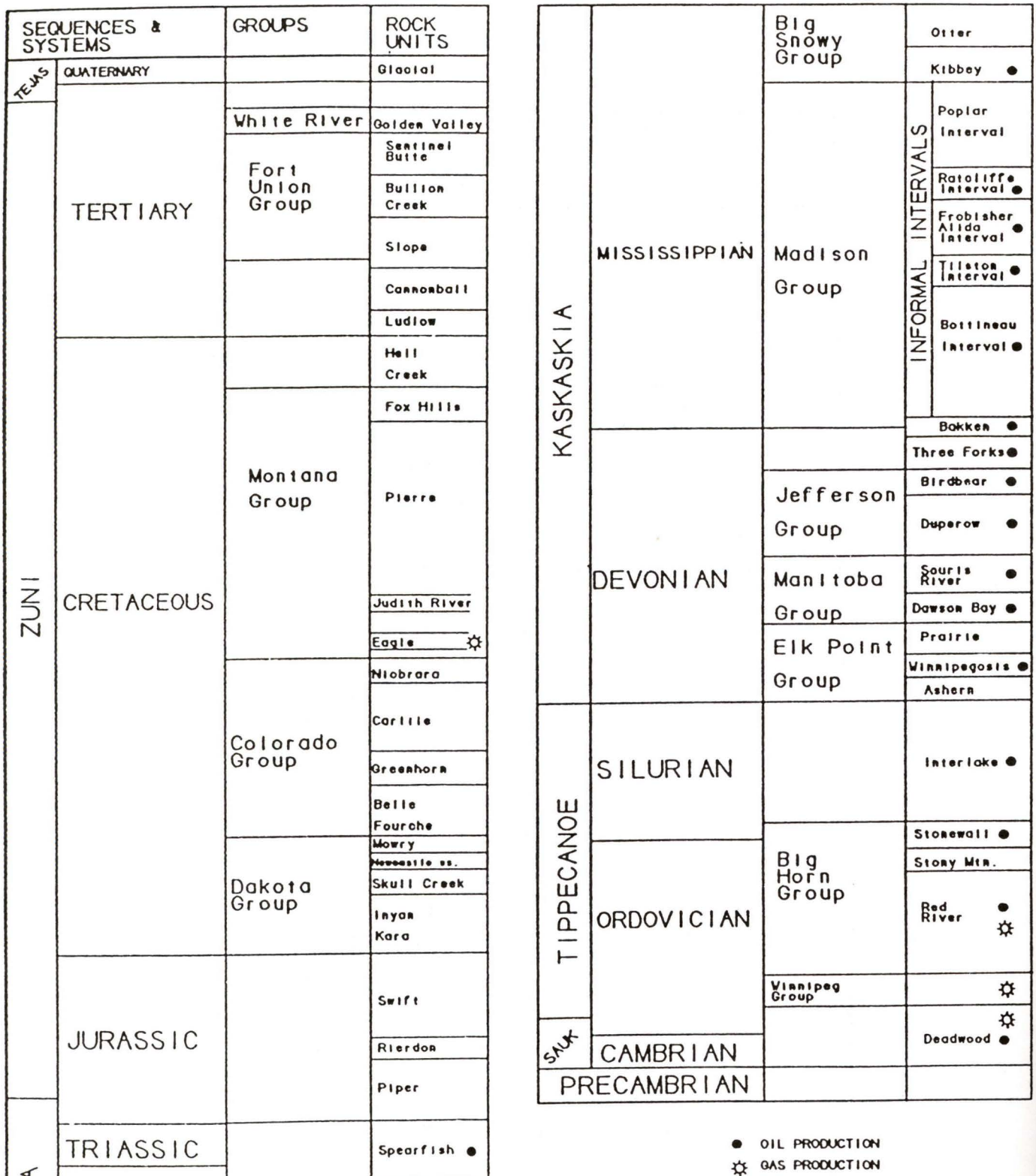


Figure 4. Stratigraphic Column for North Dakota. From Heck, 1990a.

GEOLOGY AND MINERAL POTENTIAL OF THE WILLISTON BASIN, SOUTHWESTERN NORTH DAKOTA

George Long
March 26, 1993

A. WILLISTON BASIN OVERVIEW

The Williston Basin is unique in several ways. It is a large basin that has persisted on the shelf, or cratonic foreland from precambrian time to the present. All System ages (epochs) are represented in the approximately 17,000 feet of sediments preserved in this basin (Figure 4). This does not mean that deposition was continuous. There are numerous erosional unconformities and stratigraphic changes caused by basin tilting, sea-level changes, and transgressive - regressive marine and non-marine deposition. (1)

Marine source beds were developed in the Ordovician, Devonian, Mississippian, Pennsylvanian, and Cretaceous Systems. The Tertiary System is predominantly non-marine, but contains a lot of hydrocarbon as lignite.

Reservoir rocks are present in all groups from the Cambrian Deadwood formation up through the Triassic Spearfish formation, as evidenced by oil and/or gas production, except for the Permian. The Broom Creek formation of the Upper Minnalusa Group of the Permian System does not produce oil or gas, but a sizeable reserve of nitrogen gas has been indicated. It has not been exploited. The Eagle formation of the lower Montana Group of upper Cretaceous age produces gas.

There are numerous other intervals that are not now productive which appear to have reservoir properties if encountered in trapping conditions. These include, but are not limited to, the Minnekahta formation of Permian age, several formations in the Dakota Group of lower Cretaceous Age, the Greenhorn formation in the Colorado Group of Cretaceous age, the Hell Creek formation of late Cretaceous age, and individual sands in Tertiary age rocks.

That particular portion of the Williston Basin which contains the Southern Little Missouri National Grasslands (Figure 1) is contained within T. 133 N. through the southern two tiers of secs. in T. 139 N., R. 99 W. through R. 106 W. (to the Montana state line). Total sediments above precambrian are about 11,000 feet thick at the southwest corner and over 14,000 feet thick at the northeast corner. Average regional dip is two-thirds of 1 degree at N. 45 degrees E. (about 60 feet per mile).

Producing fields include Medora in T. 139 N., R. 102 W., which produces from the Heath (Tyler) and the Madison; Norwegian Creek in sec. 27, T. 139 N., R. 100 W., which produces from the Madison; Fryburg in T. 139 N., Rs. 100 and 101 W., which produces from the Heath (Tyler) and Madison; Tracy Mountain in T. 139 N., R. 101 W., which produces from Heath (Tyler) and Madison; Davis Creek in sec. 32, T. 139 N., R. 100 W., and secs. 7 and 8, T. 138 N., R. 100 W., which produces from the Madison; Fryburg extension (SW Tracy Mountain) in T. 138 N., R. 101 W., which produces from Heath (Tyler); an unnamed field in sec. 26, T. 138 N., R. 102 W., producing from Heath (Tyler); Rocky Ridge in Ts. 136 and 137 N., R. 100 W., producing from Heath (Tyler); Bull Run in sec. 25, T. 136 N., R. 106 W., producing from Ordovician Red River; Cash in sec. 14, T. 135 N., R. 106 W., producing from Red River; and Cannonball in sec. 26, T. 135 N., R. 106 W., also producing from Red River.

In addition to the Heath (Tyler), Madison, and Red River production within the study area, there is adjacent production from the Devonian at Williams in T. 137 N., R. 106 W.

Hydrocarbon shows have been reported from other formations as well. For example: sec. 35, T. 134 N., R. 101 W. (2) The Muddy sand tested 3,752 feet of gas cut water in 1 hour from 70-foot gross, 50 feet of net sand in three benches. These are very porous sands that attain 30 percent sonic porosity. No pursuit of this gas show has been made. Anticipated increases in gas prices may spur future shallow exploration in this area.

Another example is in sec. 16, T. 135 N., R. 100 W. (NDGS circ. #224). This well tested an interval in the Big Snowy Group, probably Kibby. In a 2-hour test it had gas to the surface in 15 minutes which burned for over an hour. Recovery was brackish water which almost flowed to surface. No follow-up to this gas show has been done in the 36 years since it was drilled. This play may also develop when gas prices increase.

A third example is in sec. 9, T. 136 N., R. 105 W. This well recovered 144 cc of oil in the sample chamber during a test of the Red River. No offset has been drilled. Seismic interpretations may not have been able to delineate a structurally higher drill site, but this area may experience more activity if oil prices go up.

There are 35 1/3 townships included in the SLMNG study area. About 65 percent (23 townships) have fewer than 4 tests (4 tests per township equals 1 test per 9 square miles or 5,760 acres). This sparse evaluation may be partly due to two things: existing fields have relied heavily on seismic determination of structural closure; and geologic studies that indicate more favorable areas in other parts of the basin.

The technical advances in seismic acquisition and interpretation allow it to be applied to changes in stratigraphy and not just for structural determination. Even a cursory look at current producing formations indicates that stratigraphy is instrumental in many of these hydrocarbon traps.

The SLMNG appears to be an area where strong structural traps are scarce, but well logs indicate that stratigraphic changes can be expected to isolate undiscovered oil and gas pools.

B. OCCURRENCE POTENTIAL

In keeping with the foregoing discussion, it appears that areas of LOW occurrence potential occur along the southeastern one-third of the SLMNG (Figure 2) and the northwestern 1* townships. Even in T. 136 N., R. 99 W., there were oil and/or gas shows in cores in four of nine dry holes. The well in sec. 30, cored oil shale in the Tyler. There appears to be an absence of reservoir rock in the Tyler in this part of the township. The only deep well (below 9,000 feet) was drilled in sec. 22 and had gas shows in the Red River. (2)

All other lands in the SLMNG are classified as having MODERATE occurrence potential except for the HIGH occurrence potential assigned to the developing Tyler play.

The zero line of the Bakken play is essentially parallel to the strike of the Williston Basin in this area. It is drawn from the southeast corner of T. 139 N., R. 99 W., northwestward to the center of the west line of T. 140 N., R. 101 W. (3) This means that none of the SLMNG can be considered in the Bakken play. The area northeast of the SLMNG is from 9 to 30 miles southeast of the developed portion of the Bakken "fairway," as it is currently recognized. So, no lands in the SLMNG are definitely within the undeveloped extension of the "fairway."

The developing Tyler play has already extended 9 miles southwest of Fryburg field with the possibility of extending another 5 miles into sec. 1, T. 137 N., R. 103 W. A proposed well in sec. 20, T. 137 N., R. 101 W., would extend it due south about 7 miles. This latter location may be on a seismic indication of a channel sand similar to Rocky Ridge, whereas the well in sec. 1, T. 137 N., R. 103 W., may be on a possible southwest extension of the Tyler shoreline.

On March 24, a new prolific producer was reported to the North Dakota Industrial Commission. The #74 Dickinson - State has been completed as a Lodgepole (lower Madison) discovery flowing 2,045 barrels of oil and 1.164 million cubic feet of gas per day. The operator has staked two offsets. One is a diagonal 40 acres to the southwest, the other is * mile east of this discovery. This area is 75-80 miles from the nearest established Lodgepole production. It is about 20 miles northeast of the SLMNG. The oil is probably coming from the Bakken, and has migrated upward into the Lodgepole due to fractures and a porosity increase from less than 3 percent to over 5 percent. A quick look at deep wells between this discovery and the SLMNG reveals matrix porosity of 3 percent, or less, in this intervening area in the lower Lodgepole, except for T. 137 N., R. 97 W., where a well in sec. 9 has 5* percent sonic porosity. This test is also devoid of Bakken with the zero isopach between it and a well 2 miles northeast. Further examination of this interval in the SLMNG by industry may evolve into some exploratory drilling for lower Lodgepole pools.

REFERENCES

Geologic Atlas of the Rocky Mountain Region, Rocky Mountain Assoc. of Geologists, 1972, W. W. Mallory, ed., pp. 56, 79, 87, 94, 102, 115, 146, 169, 180, 197, 199, 207, 237, and 259.

Electric logs and Petroleum Information cards.

Hansen, William B. and Long, George I. W., 1991 Bakken Production and Potential in the U.S. and Canada: Can the Fairway be defined?, Montana Geological Society, "Geology and Horizontal Drilling of the Bakken Formation," p. 76, fig. 7.

METHODOLOGY FOR PRODUCING THE RFD MAP OF HYPOTHETICAL WELL LOCATIONS FOR THE SOUTHERN LITTLE MISSOURI AND CEDAR RIVER OIL AND GAS LEASING EIS

Greg Visconty
July 8, 1992

A. INTRODUCTION

This section describes the process used to plot hypothetical oil wells and associated access roads for the Southern Little Missouri and Cedar River Oil and Gas Leasing EIS. This map was produced in compliance with 36 CFR 228.102(c)(3), in order to analyze site specific direct, indirect and cumulative effects associated with the leasing decisions to be made in this document.

It is important to remember that the well locations depicted on the this map are ***hypothetical***, for analysis purposes only – actual wells will not necessarily be drilled at these locations. After the leasing decision is made in the Record Of Decision and leases are let, no additional ***leasing*** analysis will be necessary when APDs are filed with specific proposed well locations.

B. METHOD

The RFD, produced by Lee Jefferis of the Dickinson BLM Office, was used to determine the number of wells to be plotted on the District map. The RFD estimated a range of wells between 90 and 130, however, 130 wells were used for the map in order to realize the full impacts that could be expected, both to the environment as well as to the industry.

Three "undiscovered" oil fields and two additional historical target areas were delineated with assistance from Lee on the map; the Tyler and Madison formations in the area of between Tracy Mountain and Bullion Butte, Red River formation near Marmarth, and a linear feature extending from the southeast corner of the project area north to the Windy Butte/Flat Top Butte area. The number of expected producers and non-producers was determined from the RFD, and the appropriate numbers applied to the three "undiscovered" field areas. The remaining wells to equal the total of 130 were plotted along the linear target and elsewhere in the project area, concentrating most of them in the area northeast of Tracy Mountain in the currently developing Tyler field.

Norm Bishop, Medora Ranger District, was consulted for current exploration and production trends, along with maps produced by North Dakota Industrial Commission showing current producing and dry wells drilled in the project area. This information was used to plot hypothetical producers versus non-producers throughout the project area.

Initially, a blueline map of the Medora District map was used to plot wells so that no consideration would be given for surface or subsurface ownership. The remaining few wells that were to be plotted at random outside the field and target areas were plotted on currently leased Federal and State mineral lands, reasoning that there had been some industry interest there at one time. When the majority of wells were plotted, they were transferred to a colored District map (included in the Project File).

The RFD also estimated that two dry wells would be drilled in the Cedar River area. According to the RFD, almost all of the Forest Service lands in Cedar River are in the LOW potential area. The two wells were plotted towards the center of the MODERATE potential area, however, there are no Forest Service lands near this area, and these two wells were plotted on State and split estate lands. These two wells are not included in the 130 wells discussed above.

All of the well locations were then transferred to USGS quadrangle maps in order to establish reasonable access routes from existing roads. All of this information was then digitized into the BLM GIS system for analysis.

Tables E-6 through E-8 display the wells by surface and subsurface ownership, and by currently leased Federal and State lands.

C. CONCLUSION

Of the estimated 130 wells from the BLM RFD, approximately half of them would be drilled on State and private minerals, regardless of any leasing activity by the Forest Service.

TABLE E-6

RFD STATISTICS
TOTAL OF ALL WELLS IN ALL TARGET AREAS [1]

TARGET AREA/FORMATION	FED/FED	CURRENT FED LEASE	FED/PVT	CURRENT STATE LEASE	PVT/FED	CURRENT FED LEASE	PVT/PVT	CURRENT STATE LEASE	TOTAL
RED RIVER	9	(9)	-----	-----	-----	-----	3	(2)	12
MADISON	2	-----	1	(1)	1	(1)	2	(2)	6
TYLER	5	(1)	16	-----	-----	----	14	(7)	35
TYLER (Tracy Mountain)	43	(23)	4	-----	6	(1)	14	(9)	67
OTHER AREAS	3	(2)	-----	-----	-----	-----	7	(3)	10
TOTAL	**62**	**(35)**	**21**	**(1)**	**7**	**(2)**	**40**	**(23)**	**130**

[1] Does not include the two dry wells expected in the Cedar River area.

TABLE E-7

RFD STATISTICS
TOTAL EXPECTED PRODUCING WELLS IN ALL TARGET AREAS

TARGET AREA/FORMATION	FED/FED	CURRENT FED LEASE	FED/PVT	CURRENT STATE LEASE	PVT/FED	CURRENT FED LEASE	PVT/PVT	CURRENT STATE LEASE	TOTAL
RED RIVER	1	(1)	-----	-----	-----	-----	1	(1)	2
MADISON	1	-----	-----	-----	-----	-----	2	(2)	3
TYLER	1	-----	14	-----	-----	----	10	(5)	25
TYLER (Tracy Mountain)	28	(13)	2	-----	4	-----	7	(5)	41
OTHER AREAS	-----	-----	-----	-----	-----	-----	-----	-----	-----
TOTAL	**31**	**(14)**	**16**	**-----**	**4**	**-----**	**20**	**(13)**	**71**

TABLE E-8

RFD STATISTICS
TOTAL EXPECTED DRY WELLS IN ALL TARGET AREAS

TARGET AREA/FORMATION	FED/FED	CURRENT FED LEASE	FED/PVT	CURRENT STATE LEASE	PVT/FED	CURRENT FED LEASE	PVT/PVT	CURRENT STATE LEASE	TOTAL
RED RIVER	8	(8)	-----	-----	-----	-----	2	(1)	10
MADISON	1	-----	1	(1)	1	(1)	-----	-----	3
TYLER	4	(1)	2	-----	-----	----	4	(2)	10
TYLER (Tracy Mountain)	15	(10)	2	-----	2	(1)	7	(4)	26
OTHER AREAS	3	(2)	-----	-----	-----	-----	6	(3)	10
TOTAL	**31**	**(21)**	**5**	**(1)**	**3**	**(2)**	**20**	**(10)**	**59**

APPENDIX F

METHODOLOGY USED TO DETERMINE LEASE PARCELS FOR CURRENTLY UNLEASED AREAS

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX F

A. METHODOLOGY USED TO DETERMINE LEASE PARCELS FOR CURRENTLY UNLEASED AREAS (FS Administrative Procedures for Identifying Oil and Gas Lease Parcels on the Southern Little Missouri and Cedar River National Grasslands)

The Bureau of Land Management and Forest Service adjudicators held a coordination meeting in March 1989 and agreed to the approach used by Region 1 for parcelling of oil and gas lease offers. All laws and regulations pertaining to leasing were complied with.

1. AVAILABLE LANDS (43 CFR 3120.1.1)

The Mineral Leasing Act of 1920, as amended, provides that all public lands are open to oil and gas leasing unless specifically closed. Based on the Federal Onshore Oil and Gas Leasing Reform Act of 1987, all lands in oil and gas leases that have been terminated, expired, cancelled of relinquished are available. Land not previously leased is also considered administratively available and will be nominated by the Forest Service.

Lands prohibited from leasing are:

a. Lands withdrawn from mineral leasing by an act of Congress or by Secretarial Order.

b. Lands recommended for Wilderness allocation in the Forest Plan.

c. Lands designated by Congress as wilderness study areas, except where oil and gas leasing is specifically allowed to continue by the statute designating the study area.

d. Lands within areas allocated for wilderness or further planning in Executive Communication 1504, Ninety-sixth Congress, unless such lands are allocated to uses other than wilderness by a land and resource management plan or have been released to uses other than wilderness by an act of Congress.

2. FEDERAL MINERAL OWNERSHIP

The following categories of lands were reviewed and identified as to availability for leasing:

a. Public Domain - Lands or interest in lands which never left the ownership of the United States, lands which were obtained by the United States in exchange, and lands which have reverted to the ownership of the United States through operation of public land laws.

b. Acquired - Lands which the Forest Service obtained by deed through purchase, gift, or condemnation proceedings.

c. Split Estate - Lands where the surface estate is owned by one entity and the mineral estate is owned by another. Non-Federal surface and Federal oil and gas mineral rights were identified for leasing. In accordance with a Interagency Agreement with the Montana State Office of the Bureau of Land Management, split estate lands that are within the boundaries of a National Forest System unit are to be addressed in Forest Service environmental documents and offered for lease.

d. Outstanding Minerals - A significant number of properties were acquired by the Federal government subject to a reservation of mineral interests for a specific number of years. The deeds either have an expiration date or a conditional expiration date. In most cases rights were reserved to use the surface in conjunction with development, production, and marketing of reserved minerals. Terms of these reservations vary with the most common term being 50 years. They begin to revert to the US after the year 2000. The reservation would be extended if production is occurring at the agreed upon date of reversion.

3. PARCEL LEGAL DESCRIPTIONS

The following two methods were used to describe a oil and gas competitive lease parcel:

Rectangular System of Survey - The lands were described by legal subdivision, section, township, range and meridian. Any boundaries that did not conform are described by metes and bounds.

Metes and Bounds - Description of land giving courses and distances between successive angle points with appropriate ties to the nearest official survey points. All description were taken from previously leased descriptions or were obtained from the Bureau of Land Management cadastral survey staff at the Montana State Office. Examples where metes and bounds were used are:

- Riverbeds
- Road right-of-ways
- Irregular boundaries outside Theodore Roosevelt National Park

4. PARCEL IDENTIFICATION

Guidelines - In addition to the regulations, the following guidelines were followed:

- Forest Service parcels were not combined with any other agency surface administration areas.
- Parcels were located within a single township.
- Parcels did not cross district boundaries in order to simplify administration.
- Parcels contained either public domain or acquired minerals, surface ownership was not a factor in parcel configuration.
- Parcels are as compact or contiguous as possible.
- Industry requested parcels were complied with, if at all possible.

Parcels Determined by Bureau of Land Management Adjudicators - The Bureau of Land Management may dictate parcel configuration for acreage they determine to be subject to drainage or within areas of unleased unitized or communitized lands. In most cases, the request will be assigned a serial case number from the Bureau of Land Management and will be referenced when responding to the Bureau of Land Management. Any informal expressions of interest or presale offers are forwarded on to the Forest Service to assist in parcel identification by the Forest Service.

Parcels Determined by Forest Service Adjudicators - The Forest Service used its discretion to decide how much acreage would be included in each parcel up to the maximum acreage of 2,560 acres. The primary factors to be considered are: the extent of public domain or acquired lands available within the township; the goal to have the parcels as compact as possible; and expressions of interest received from industry. Several letters of interest were received for the same lands, often requesting slightly different configurations. Our intent was to meet the needs of the public and promote competition in conformance with the Mineral Leasing Act, as amended by the Reform Act. Previous configurations of expired, terminated, relinquished, or cancelled leases did not govern the new parcels.

5. PARCEL PRIORITIZATION

Parcels and their appropriate stipulations will be forwarded to the Bureau of Land Management in manageable numbers for each scheduled Bureau of Land Management competitive lease sale. The parcels will be prioritized as follows:

a. Drainage Parcels
b. Unleased unit/communitized parcels
c. Specific industry requested parcels by date (oldest first)
d. Serialized presale offers by date
e. General industry requested parcels by date
f. Forest Service nominated parcels based on high to moderate mineral potential

APPENDIX G

CONDITIONS OF APPROVAL

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX G

A. CONDITIONS OF APPROVAL

A Condition of Approval (COA) is generated at the time of site specific analysis when a Surface Use Plan of Operations for drilling of a well has been received. A COA's purpose is to offer mitigation specific to the proposal, i.e. soil erosion reduction, ground water protection, selection of vegetation favorable to wildlife and domestic livestock, etc.

COAs may not unduly hinder or preclude the lessee's/operator's opportunity to exercise valid existing rights. COAs may only be applied if they are consistent with the lease terms or their use has been accepted through negotiation.

COAs may be applied to all oil and gas activities, including associated access routes and/or rights-of-way. The Authorized Forest Officer may select from the list of COAs found below, adjust them as conditions warrant, or may even develop new COAs if the site specific analysis identifies conditions not addressed by currently available COAs.

COAs are not added to drilling permits if they are unnecessary or duplicate efforts already contained in the lessee's/operator's submittal.

The list below is not intended to be all inclusive and, again, any of the listed COAs may be adjusted or new ones developed to fit the specific situation for which it is to be applied.

CONDITIONS OF APPROVAL (COA)	ADMINISTRATIVE/MITIGATION OBJECTIVE(S)
CONSTRUCTION	
1. Single-lane access roads will be constructed and maintained according to a Forest Service typical profile and specification as indicated on the attached Exhibit A (General Road Construction and Rehabilitation Specifications), and Exhibit B (Standard Construction and Maintenance Specifications, and Road Data Sheet). The access road shall be accepted by the Forest Service prior to moving equipment onto location. In the event that construction activity occurs during winter conditions, the construction requirements may be modified for winter time access, the road will be completed to final standards within the next six months.	Applies to access road needed for the drilling locations. Use of this COA ensures that proper engineering practices for protection of soil and water resources and safety procedures will be followed. Also ensures that access roads be accepted before moving equipment onto location. Meets Custer National Forest Management Plan Standards (CNFMPS) 11. a. 1)-4), pages 36-38.
2. The access road to this well will have a complete survey and design and shall be approved by the Forest Service Engineering Section prior to construction. Design(ed) section(s) will be construction staked to ensure compliance with the survey and design. Cut and fill stakes are to remain in place after construction. All design construction will be under the direct supervision of a registered engineer to to be provided by the operator. The access road shall be accepted by the Forest Service prior to moving equipment onto the location. The permanent access road(s) will be constructed and maintained according to Forest Service approved specifications as indicated on the attached Exhibit A (General Road Construction and Rehabilitation Specifications), and Exhibit B (Standard Construction and Maintenance Specifications, and Road Data Sheet). In the event that construction activity occurs during winter conditions, the construction requirements may be modified to provide access and minimize environmental damage. In those cases where the project is modified for winter time access, the road will be completed to final standards within the next six months.	Applies to access road needed for the drilling location. Use of this COA ensures that proper engineering practices for protection of soil and water resources and safety procedures will be followed. Also ensures that access roads be accepted before moving equipment onto location. Meets CNFMPS 11. a. 1)-4) pages 36-38.
3. The operator has the option to construct the road to temporary standards during the drilling phase of the well according to the specifications in attached Exhibit C (Temporary Road Guidelines).	Applies to access road needed for the drilling location. Use of this COA ensures that proper engineering practices for protection of soil and water resources and safety procedures will be followed. Meets CNFMPS 11 a. 4) b) pages 36-38.

CONSTRUCTION	
4. The off-lease portion of the access road through Section __ , T __ S, R __ E, will require a Forest Service special use permit for road construction. No construction activity will commence until the operator receives this approved permit.	Identifies that a special use permit is needed for off-lease access road and also enforces that no construction will take place until a special use permit is granted. Meets CNFMPS 8. c. 6) and d. 3) page 28 and 10. b. 2) e) page 34.
5. The production facilities and tanks for this well will be located on-lease/at the __ - __ of Section _ , T __ S, R __ E. The location of the flowlines and facility site will be agreed to and staked with approval of the U.S. Forest Service.	Identifies that production facilities are located off the drill pad and the site and flowlines need to be staked and approved.
6. A prework conference shall be held prior to any earth disturbing activities and a starting date established. This will include, at a minimum, the operator or his/her authorized representative, the dirt contractor, and the authorized Forest Service officer. The lead operator is responsible for scheduling and holding this meeting in a timely manner sufficient for resolving any potential problems prior to actual construction. The Forest Service shall be notified in the event the established stating date is changed. The Forest Service will then determine if another prework conference is necessary.	Usually done with road access and well staked and any problem areas discussed. To ensure resource mitigation and/or protection identified in the Decision Notice/Record of Decision is noted by the operator prior to ground disturbance. Required by Onshore Operating Order #1.
7. The operator will provide the dirt contractor with a copy of Forest Service Standard Specifications for Construction of Roads and Bridges (EM-7720-100) (see Exhibit B) along with everything referenced in Stipulation 1 or 2, whichever is applicable. Construction operations may be suspended if the contractor fails to have these document on-site.	Requires contractor to have a copy of Forest Service Standard Specifications for Construction of Roads and Bridges (EM-7720-100) with Exhibit B telling which specifications apply to this project. Mitigates soil and erosion disturbance.
8. If, prior to or during construction, items of archeological, paleontological, or historic value are reported or discovered, or an unknown deposit of such items is disturbed, the operator will immediately cease construction in the affected area and notify the Forest Service. Construction will not resume until approval is given by the Forest Service.	Although archeological clearance is required, this COA adds more responsibility to the operator to protect archeological, paleontological or historic resources.

CONSTRUCTION	
9. The operator is responsible for locating and protecting underground pipelines and electric transmission lines.	To ensure the public safety and uninterrupted service, to prevent fires due to explosion of accidentally released gasses or cut electric transmission lines the operator, not the Forest Service, must locate and protect underground pipelines and electric transmission lines.
10. The operator shall protect, in place, all public land survey monuments, private property corners, and Forest Service boundary markers. In the event that any land markers or monuments are destroyed in the exercise of their rights, depending on the type of monument destroyed, the operator shall see that they are re-established or referenced in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the county surveyor, or (3) the specifications of the Forest Service.	To maintain an ordered land monument system this COA requires re-establishment of a disturbed public land survey monuments, private property corners, and Forest Service boundary markers, by the operator.
11. No surfacing material or scoria will be taken from Forest Service lands.	Surfacing material cannot be utilized without the issuance of a Contract For The Sale of Mineral Materials permit, Forest Service form FS 2800-9 (12/89).
12. A reserve pit liner will be required. The liner will have a burst strength of not less than 140 psi. If the reserve pit is excavated through sand, coal, or scoria, the liner will have a burst strength of not less than 200 psi, and any sand, coal, or scoria will be covered with 6 inches of clay before the liner is installed. This may require re-sloping of the pit walls. No trash will be disposed of in the reserve pit.	A reserve pit liner is used to prevent loss of drilling fluids which may have the potential to destroy vegetation and to contaminate surface and ground water supplies. To maintain the integrity of the pit liner during the drilling of the well the clay is required where the surface of the pit has the potential to puncture the liner. Likewise, in order to maintain the integrity of the pit liner, the disposal of trash in the reserve pit is prohibited. Meets CNFMPS8. c. 4) a) and b) page 27.
13. Fencing, screening, and netting of pits is *advised* where open storage vessels, earthen pits, or ponds may contain oil, oil residue, or waters with more than 15,000 parts per million (ppm) total dissolved solids. This measure is intended to prevent death or injury to birds and mammals.	Responds to U.S. Fish and Wildlife Service concern regarding potential hazard that reserve pit fluids represent to migrating waterfowl and small mammals.
14. The operator will contact the Forest Service when construction activity is completed. The Forest Service will then make a final inspection and document its acceptance or will identify the specific items which do not meet acceptance standards.	

DRILLING OPERATIONS	
15. The reserve pit will be fenced on three non-working sides during drilling. After drilling is completed, the fourth side of the pit will be fenced until the pit is reclaimed. The entire disturbed location will be fenced after seeding. Fences and cattleguards must meet Forest Service specifications. Once the location has been rehabilitated and vegetation re-established, the fence will be removed or the fenced area reduced as required by the Forest Service.	Prevents entry into the reserve pit by domestic livestock and/or wild animals. After seeding, the disturbed location is fenced to allow establishing vegetation on the area disturbed by operations and which, in the case of a producing well, will not be utilized for production. Re-vegetation is essential to erosion control and returning the area to a productive base for wildlife and domestic livestock. Meets CNFMPS 8.c.4) i) page 28.
16. Production water or testing tanks shall be located and/or diked so that any spilled fluids will flow into the reserve pit. Production water tanks will not be placed on topsoil stockpiles.	Fluids generated by well testing have the potential to adversely affect vegetation and water quality. The use of diking is a measure to control accidental spills or releases of fluids produced during well testing. No tanks allowed on topsoil stock piles to lessen any chance of topsoil, to be used in site reclamation, contamination. Meets CNFMPS 8. c. 4) f) and g) pages 27 and 28.
17. Portable dumpsters will be used for all trash. All trash will be hauled off-site, no burning will be allowed.	To ensure that trash generated by drilling operations is disposed of in an approved landfill as well as to lessen chances of adverse effects to air and water quality. Meets CNFMPS 8. c. 4) b) page 27.
18. Sewage will be disposed of according to county and state requirements in a portable chemical toilet or in a home at least 15 feet deep excavated in the cut portion of the well pad.	To prevent contamination of water resources.
19. The operator shall notify the District Ranger of the rig release date within two working days of that date. The drilling rig shall be removed from the location within 30 days of the completion of drilling unless prior approval is granted by the Forest Service. Rig stacking on Forest Service System lands may be permitted under a special use permit.	The storage of unused drilling equipment on Forest Service System lands requires a special use permit. Meets CNFMPS 10. b. 2) l) page 35.

PRODUCTION FACILITIES	
20. If a tank battery is constructed, each and every tank setting, treater, and separator must be surrounded on all four sides by an impermeable dike/berm of sufficient capacity to adequately contain the contents of the largest vessel within the dike plus one day's production. Load lines must terminate within the dike.	In case of a tank battery spill the diking will contain the spill. This serves to limit the area of contamination, facilitate clean up, and to lessen potential adverse affectation, wildlife, and water quality. Meets CNFMPS 8. c. 4) g) page 28.
21. All vent lines must terminate within the diked area or be designed so that no liquids can flow out of the vent lines.	This is to insure that oil liquids are contained within the diked area, thereby limiting the area of potential contamination, to facilitate clean up, and to lessen potential adverse affects to vegetation, wildlife and water quality. Meets CNFMPS 8. c. 4) g) page 28.
22. All internal combustion engines associated with production facilities will be equipped with noise-reducing mufflers.	Reduces noise generated by a location.
23. All above-ground facilities will be painted earthtone colors (Munsell Soil Color **Desert Brown #10YR6/3**) within six months of the well completion.	To minimize visual impact and to achieve visual management objectives. Meets CNFMPS 8. c. 4) h) page 28.
24. The operator must maintain vegetative control on the area of operation including a 30 foot minimum bare ground area around any source of open fire. The operator shall maintain the area to be cleared by means of chemicals only after the Forest Supervisor has given specific written approval. Application for such approval must be in writing and must specify the time, method, chemicals and the portion of the area to be chemically treated.	Reduce fire hazard potential around open flames and to prevent the use of chemical herbicides that may have an adverse effect on vegetation and wildlife and/or may not be approved for use on lands administered by the Federal Government. Meets CNFMPS 5. e. 3) page 24 and 8. c. 8) page 28.
25. Fire prevention and suppression requirements for operations on Federal lands are found in stipulations (Exhibit C) in the Surface Use Plan.	Fire prevention plan to reduce fire hazards and specify needed fire equipment. Meets CNFMPS 12. b. 3) d) page 39.
26. No permanent above ground pipelines will be approved between the well head and treater or between the treater and flare pit.	Eliminates sources of potential accidental fluid release which might have an adverse affect on vegetation, wildlife and water quality.
27. Outdoor area lighting fixtures will be allowed on production facilities and may only be used when personnel are present on location.	Mitigates unnecessary lighting at night so as to meet visual management objectives. Meets CNFMPS 8. c. 4) h) page 28.

PRODUCTION FACILITIES	
28. All spills (produced water or oil) or pipeline breaks outside the diked area shall be reported within 24 hours to the Forest Service.	Timely notification allows for immediate attention by the Forest Service. Meets CNFMPS 8. e. 1)-3) and 8. f. 1)-2) page 28.
29. As built survey plats will be submitted to the U.S. Forest Service upon completion of all roads and pipelines, and will be prepared in accordance to stipulations attached (Exhibit D) in the Surface Use Plan.	Ensures the Forest Service has a final plat of the completed project. Where applicable, the submitted information will be included in the Forest transportation and Forest/District maps. Meets CNFMPS 11. a. 3) a) page 37.

REHABILITATION	
30. Seed mixtures to be used in rehabilitating this site will be provided by the Forest Service. The mixture shall be certified weed free; a copy shall be supplied to the Forest Service prior to planting. Seeding will be accomplished during the spring or fall seeding period as directed by the Forest Service.	Seed mixtures are site specific for land forms and are used to reduce soil erosion and provide immediate vegetative cover. For best effects seeding is usually done in April-May or mid-September to mid-November. Meets CNFMPD 8. c. 4) 5) page 28.
31. If this well is a producer, all site rehabilitation shall be completed within six months. As a general guideline, under normal weather conditions the timetable for rehabilitation will allow two months for the mud to settle in the reserve pit, two months for backfill settling upon pit closure, and two months to complete final re-contouring and spreading of topsoil. Before any production facilities are constructed, a site reclamation plan will be prepared by the operator and Forest Service for all disturbed areas not required for production facilities. "Trenching" of the reserve pit during the pit reclamation phase will not be allowed unless approved in the site reclamation plan. In the event of winter freeze-up, reclamation will be put on hold as determined by the Forest Service.	Ensures timely restoration of site and reclamation of reserve pit and any unused portions of well site to mitigate soil erosion and to return the site to a condition more favorable to wildlife and domestic livestock. Meets CNFMPS 8. c. 4) 5) page 28.

PREWORK	
32. At the Forest Service request, the operator will provide an inventory of the kinds and amounts of all chemical, additives, and substances used in drilling.	Information essential to a historical inventory of substances utilized in the drilling of a well. Meets CNFMPS 8. f. 1) and 2) page 28.
33. At such time as the well is abandoned, the operator shall contact the Forest Service for development of the final reclamation plan.	Ensures timely Forest Service involvement in the development of a final rehabilitation plan. The plan must consider means to prevent soil erosion, adverse affects to water quality, and to return the site to a condition productive to wildlife and domestic livestock. Meets CNFMPS 8. c. 5) page 28.
34. If this well is a non-producer, the entire location and access road will rehabilitated within six months from the date the well is plugged. The rehabilitation timetable will be the same as in stipulation number 31 above.	Ensures timely restoration of site after abandonment and requires seed mixture approval of the Forest Service. As a result, potential soil erosion will be reduced and the site will be returned to a condition productive to wildlife and domestic livestock more quickly. Meets CNFMPS 8. c. 5) page 28.
35. If this oil well site is constructed and not drilled, the site and access road must be reclaimed or Forest Service approved special erosion control measures implemented within 90 days of site construction unless otherwise approved in writing by the District Ranger.	Reduces potential soil erosion, adverse affects to water quality, and more quickly returns the site to a condition productive to wildlife and domestic livestock. Meets CNFMPS 8. c. 5) page 28.
36. If this well is temporarily abandoned after drilling, rehabilitation will be completed within six months according to the specifications set forth in stipulation number 31 above.	Reduces potential soil erosion, adverse affects to water quality, and more quickly returns the site to a condition productive to wildlife and domestic livestock. Meets CNFMPS 8. c. 5) page 28.
37. At such time as the well is abandoned, the operator is required to identify the well location with the appropriate information as required by state law. Said information will be placed on a flat plate, or survey marker, attached to the well casing so the marker is buried from two to six feet below the re-contoured surface. The plate/marker sealing the casing is required to have a "weep hole" (1/8"-1/4") which will allow pressure to dissipate and facilitate detection of any fluid seepage.	Buried abandoned well markers meets visual management objectives and the "weep hole" in the casing will allow for the detection of fluid seepage which could result in adverse affects to water quality. Meets CNFMPS 8. c. 4) h) and 8. f 1)-2) page 28.

OTHER CONDITIONS OF APPROVAL	
38. The following modifications were agreed upon at the on-site inspection and are included as part of the conditions for the construction of this well location: (To be listed as agreed upon).	Agreed upon modifications are fully documented and included in the Conditions of Approval.

FOREST SERVICE STANDARD CONDITIONS OF APPROVAL
FOR FEDERAL SURFACE AND FEDERAL MINERALS

ADDITIONAL CONDITIONS OF APPROVAL MAY BE DEVELOPED DURING THE ENVIRONMENTAL ANALYSIS PROCESS AND WILL BE ATTACHED TO THE SURFACE USE PLAN. APPROVAL OF THE SURFACE USE PLAN WILL BE CONTINGENT UPON THESE CONDITIONS BEING MET.

Operator Name and Well No.:

Legal Description:

For conditions 1 thru 5, (X) the conditions that apply.

CONSTRUCTION

( ) 1. Single-lane access roads will be constructed and maintained according to a Forest Service typical profile and specification as indicated on the attached Exhibit A (General Road Construction and Rehabilitation Specifications), and Exhibit B (Standard Construction and Maintenance Specifications, and Road Data Sheet). The access road shall be accepted by the Forest Service prior to moving equipment onto location.

In the event that construction activity occurs during winter conditions, the construction requirements may be modified to provide access and minimize environmental damage. In those cases where the project is modified for winter time access, the road will be completed to final standards within the next six months.

( ) 2. The access road to this well will have a complete survey and design and shall be approved by the Forest Service Engineering Section prior to construction. Design(ed) section(s) will be construction staked to ensure compliance with the survey and design. Cut and fill stakes are to remain in place after construction. All construction design will be under the direct supervision of a registered engineer to be provided by the operator. The access road shall be accepted by the Forest Service prior to moving equipment onto the location. The permanent access road(s) will be constructed and maintained according to Forest Service approved specifications as indicated on the attached Exhibit A (General Road Construction and Rehabilitation Specifications), and Exhibit B (Standard Construction and Maintenance Specifications, and Road Data Sheet).

In the event that construction activity occurs during winter conditions, the construction requirements may be modified to provide access and minimize environmental damage. In those cases where the project is modified for winter time access, the road will be completed to final standards within the next six months.

( ) 3. The operator has the option to construct the road to temporary standards during the drilling phase of the well according to the specifications in attached Exhibit E (Temporary Road Guidelines).

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( ) 4. The off-lease portion of the access road through Section ___ T ___, R____, will require a Forest Service special use permit for road construction. No construction activity will commence until the operator receives this approved permit.

( ) 5. The production facilities and tanks for this well will be located on-lease/at the _____ in _____ _____ of Section __, T____, R____. The location of the flowlines and facility site will be agreed to and staked with approval of the U.S. Forest Service.

6. A prework conference shall be held prior to any earth disturbing activities and a starting date established. This will include, at minimum, the operator or his authorized representative, the dirt contractor, and the authorized Forest Service officer. The lead operator is responsible for scheduling and holding this meeting in a timely manner sufficient for resolving any potential problems prior to actual construction.

   The Forest Service shall be notified in the event the established starting date is changed. The Forest Service will then determine if another prework conference is necessary.

7. The operator will provide the dirt contractor with a copy of Forest Service standard specifications for Construction of Roads and Bridges (EM-7720-100) (see Exhibit B) along with everything referenced in Stipulation 1 or 2, whichever is applicable. Construction operations may be suspended if the contractor fails to have these documents on site.

8. If, prior to or during construction, items of archaeological, paleontological, or historic value are reported or discovered, or an unknown deposit of such items is disturbed, the operator will immediately cease construction in the affected area and notify the Forest Service. Construction will not resume until approval is given by the Forest Service.

9. The operator is responsible for locating and protecting underground pipelines and powerlines.

10. The operator shall protect, in place, all public land survey monuments, private property corners, and Forest Service boundary markers. In the event that any such land markers or monuments are destroyed in the exercise of their rights, depending on the type of monument destroyed, the operator shall see that they are reestablished or referenced in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States", (2) the specifications of the county surveyor, or (3) the specifications of the Forest Service.

11. No surfacing material or scoria will be taken from Forest Service lands.

12. A reserve pit liner will be required. The liner will have a burst strength of not less than 140 psi. If the reserve pit is excavated through sand, coal or scoria, the liner will have a burst strength of not less than 200 psi, and any sand, coal or scoria will be covered with six inches of clay before the liner is installed. This may require resloping of the pit walls. No trash will be disposed of in the reserve pit.

13. Fencing, screening, and netting of pits is advised where open storage vessels, earthen pits, or ponds may contain oil, oil residue, or waters with more than 15,000 parts per million (ppm) total dissolved solids. This measure is intended to prevent death or injury to birds and mammals.

14. The operator will contact the Forest Service when the construction activity is completed. The Forest Service will then make a final inspection and document its acceptance or will identify the specific items which do not meet acceptable standards.

DRILLING OPERATIONS

15. The reserve pit will be fenced on three non-working sides during drilling. After drilling is completed, the fourth side of the pit will be fenced until the pit is reclaimed.

    The entire disturbed location will be fenced after seeding. Fences and cattleguards must meet Forest Service specifications. Once the location has been rehabilitated and vegetation re-established, the fence will be removed or the fenced area reduced as required by the Forest Service.

16. Production water or testing tanks shall be located and/or diked so that any spilled fluids will flow into the reserve pit. Production water tanks will not be placed on topsoil stockpiles.

17. Portable dumpsters will be used for all trash. All trash will be hauled off site, no burning will be allowed.

18. Sewage will be disposed of according to county and state requirements in a portable chemical toilet or in a hole at least 15 feet deep excavated in the cut portion of the well pad.

19. The operator shall notify the District Ranger of the rig release date within two working days of that date. The drilling rig shall be removed from the location within 30 days of the completion of drilling unless prior approval is granted by the Forest Service. Rig stacking on National Forest System lands may be permitted under a special use permit.

PRODUCTION FACILITIES

20. If a tank battery is constructed, each and every tank setting, treater, and separator must be surrounded on all four sides by an impermeable dike/berm of sufficient capacity to adequately contain the contents of the largest vessel within the dike plus one day's production. Load lines must terminate within the dike.

21. All vent lines must terminate within the diked area or be designed so that no liquids can flow out of the vent lines.

22. All internal combustion engines associated with production facilities will be equipped with noise-reducing mufflers.

23. All above-ground facilities will be painted earthtone color (Munsell Soil Color) Desert Brown #10YR6/3 within six months of the well completion.

24. The operator must maintain vegetative control on the area of operation including a 30 foot minimum bare ground area around any source of open fire. The operator shall maintain the area to be cleared by means of chemicals only after the Forest Supervisor has given specific written approval. Application for such approval must be in writing and must specify the time, method, chemicals, and the exact portion of the area to be chemically treated.

25. Fire prevention and suppression requirements for operations on Federal lands are found on the attached Stipulations - Exhibit C.

26. No permanent above ground pipelines will be approved between the well head and treater or between the treater and flare pit.

27. Outdoor area lighting fixtures will be allowed on production facilities and may only be used when personnel are present on location.

28. All spills (production water or oil) or pipeline breaks outside the diked area shall be reported within 24 hours to the Forest Service.

29. As-built survey plats will be submitted to the U.S. Forest Service upon completion of all roads and pipelines, and will be prepared in accordance to attached Stipulations - Exhibit D.

REHABILITATION

30. Seed mixtures to be used in rehabilitating this site will be provided by the Forest Service. The mixture shall be certified weed free; a copy shall be supplied to the Forest Service prior to planting. Seeding will be accomplished during the spring or fall seeding period as directed by the Forest Service.

31. If this well is a producer, all site rehabilitation shall be completed within six months. As a general guideline under normal weather conditions, the timetable for rehabilitation will allow two months for the mud to settle in the reserve pit, two months for backfill settling upon pit closure, and two months to complete final recontouring, and topsoiling. Before any production facilities are constructed, a site reclamation plan will be prepared by the operator and Forest Service for all disturbed areas not required for production facilities. "Trenching" of the reserve pit during the pit reclamation phase will not be allowed unless approved in the site reclamation plan. In the event of winter freeze-up, reclamation will be put on hold as determined by the Forest Service.

A PREWORK BETWEEN THE FOREST SERVICE AND THE OIL COMPANY/CONTRACTOR IS REQUIRED FOR ALL PHASES OF SITE REHABILITATION.

32. At the Forest Service request, the operator will provide an inventory of the kinds and amounts of all chemicals, additives, and substances used in drilling.

33. At such time as the well is abandoned, the operator shall contact the Forest Service for development of the final rehabilitation plan.

34. If this well is a non-producer, the entire location and access road will be rehabilitated within six months from the date the well is plugged. The rehabilitation timetable will be the same as in stipulation number 31 above.

35. If this oil well site is constructed and not drilled, the site and access road must be reclaimed or Forest Service approved special erosion control measures implemented within 90 days of site construction unless otherwise approved in writing by the District Ranger.

36. If this well is temporarily abandoned after drilling, rehabilitation will be completed within six months according to the specifications set forth in stipulation number 31 above.

37. At such time as the well is abandoned, the operator is required to identify the well location with the appropriate information as required by state law. Said information will be placed on a flat plate, or survey marker, attached to the well casing so that the marker is buried from two to six feet below the recontoured surface. The plate/marker sealing the casing is required to have a "weep hole" (1/8" - 1/4") which will allow pressure to dissipate and facilitate detection of any fluid seepage.

OTHER CONDITIONS OF APPROVAL

38. The following modifications were agreed upon at the on-site inspection and are included as part of the conditions for the construction of this well location:

APPENDIX H

GEOGRAPHIC INFORMATION SYSTEM

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX H

ANALYSIS METHODOLOGIES

The Southern Little Missouri and Cedar River Oil and Gas EIS utilized the MOSS family of Geographic Information System (GIS) software for encoding, transforming, analyzing, and displaying spatial information. This system consists of three components:

- Automated Digitizing System (ADS)
- Analytical Mapping System (AMS)
- Map Overlay and Statistical System (MOSS)
- Map Analysis and Processing System (MAPS)

Moss has been designed to allow retrieval, analysis, map displays and other spatial data stored in the system. This map data may be stored in two formats: vector or cell (raster). Vector data consists of a series of X Y coordinated forming points, lines or polygons. Each feature in a vector map may be assigned an identifying attribute based on its characteristics. Cell data consists of a regular grid pattern in which each cell in the grid is assigned an identifying value and may be created from vector data by a process called rasterizing. Accuracy, resolution, storage, and processing of cell maps is directly related to grid-cell size. For this EIS each grid-cell is equal to 0.22 acres.

The GIS data base was digitized from resource maps at the 1:24,000 or 1:100,000 scale. Maps for this EIS have been generated at a scale to allow the reader a general idea regarding the nature of the area.

The lease stipulations identified on the alternative maps would apply only to the Federal Surface/Minerals and Private Surface Federal Minerals Ownership (Split Estate). The stipulations do not apply to any lands of other ownership within the EIS boundary.

Satellite Imagery Data

Thematic Mapper (TM) data from May 1992 was used for image processing by the University of Montana. An unsupervised classification was delineated from the satellite imagery data and was processed on an ERDAS image processing system, converted to spatial analysis software and loaded onto the GIS data base.

Digital Elevation Models

Digital Elevation Models (DEM) (7.5 minute series) was obtained from the Geometronic Service Center and loaded into the GIS data base.

APPENDIX I

BIOLOGICAL ASSESSMENT

FEDERALLY THREATENED OR ENDANGERED SPECIES

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

PREPARED BY:

DON SASSE, Wildlife Biologist, USFS

BRUCE MAY, Zone Fisheries Biologist, USFS

SUSAN RINEHART, Botanist, USFS

May, 1994

(Revised April 1995)

APPENDIX I

Biological Assessment

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BIOLOGICAL ASSESSMENT

I. INTRODUCTION

An environmental impact statement has been prepared which describes and evaluates the management alternatives for the Southern Little Missouri and Cedar River National Grasslands Oil and Gas Leasing project area. The project area is located in southwestern North Dakota on the the Medora and Grand River Ranger Districts of the Custer National Forest.

The purpose of this biological assessment is to review the possible effects of the preferred alternative on Federally listed endangered or threatened species and their habitats in order to determine whether or not a "likely to adversely affect" situation exists.

The FEIS preferred alternative is Alternative 7.

Coordination with the USFWS

The Custer National Forest includes habitat for eight species listed by the US Fish and Wildlife Service (USFWS) as threatened or endangered: bald eagle (Haliaeetus leucocephalus), whooping crane (Grus americana), black-footed ferret (Mustela nigripes), peregrine falcon (Falco peregrinus), interior least tern (Sterna antillarum), piping plover (Charadrius melodus), gray wolf (Canis lupus), and grizzly bear (Ursus arctos). The Forest Plan Standard E,4,d (p. 17 - 18) instructs the Forest to comply with the Endangered Species Act of 1973, as amended, which obligates the Forest Service to conduct activities and programs which assist in identification and recovery of threatened and endangered plant and animal species (see Appendix B for further information). The US Fish and Wildlife Service (USFWS) was contacted on April 10, 1992, and again on December 3, 1993 and March 14, 1995, for a list of threatened or endangered species or listed candidate species which may be present in the project area. The USFWS responded with a list of Federally listed endangered, threatened, and candidate category 2 species (Sapa, April 22, 1992, and Collins, December 7, 1993; Collins, March 14, 1995), (see Biological Assessment, Appendix I). The gray wolf was added in the March 14, 1995 list. Table I-1 displays those threatened and endangered species or their habitat which exists in the project area.

TABLE I-1

Threatened or Endangered Species

Species [1]	Status	Existing Habitat, and Need for Further Analysis
Bald eagle	Endangered	Known existing habitat; species will be considered in analysis.
Black-footed ferret	Endangered	Non-existent within or immediately adjacent to the project area. Prairie dog towns are potential habitat; impacts on habitat will be considered in the analysis.
Gray Wolf	Endangered	No known occurrence within project area; species will not be further considered in analysis.
Interior least tern	Endangered	Known existing habitat; species will be considered in analysis.
Peregrine falcon	Endangered	Known existing habitat; species will be considered in analysis.
Whooping crane	Endangered	No known occurrence within project area; species will not be further considered in analysis.
Piping Plover	Threatened	Known existing habitat; species will be considered in analysis.
Pallid sturgeon	Endangered	No known occurrence within project area; species will not be further considered in analysis.

[1] Identified in coordination with USFWS (Sapa, April 22, 1992; Collins, December 7, 1993; Collins, March 14, 1995).

II. AFFECTED ENVIRONMENT

This section describes the rationale for probability of occurrence.

- **Bald eagle (Endangered)**

Migrating bald eagles utilize major riparian areas and ungulate winter range area in the spring and fall. Small numbers of bald eagles are seen on a regular basis during spring and fall migrations. Bald eagles are seen along the Missouri River during March-April and late October and bald eagles may migrate over the SLM project area and a few migrating birds may occasionally roost in cottonwood trees along the Little Missouri River. Up to three bald eagles have been seen along 45 miles of the Cedar River located north of the CRNG. Ponds typically freeze during winters in the project area and waterfowl and eagles shift to flowing rivers and migrate south as winter progresses. There are no known active nest sites or communal winter roost sites within the project area. There is a record of one historic bald eagle nest site in the project area. An active bald eagle nest that fledged one young was located on NFS lands near Marmarth in Section 28, NW 1/4, T. 133 N., R. 105 W., in 1975. The same nest was occupied in 1976, but was blown down by the wind. Post 1976 USFWS surveys have not detected bald eagle nesting in the area. The Forest Plan (USFS 1986, p. 19 and 172) lists a ¼ mile radius around inactive nest sites and ½ mile radius around nest sites to avoid disturbance during nesting and an ¼ mile no disturbance NSO stipulation. The period to avoid disturbance to active nests is described as Feb 15 to July 15. These standards are inconsistent with the habitat management guide for bald eagles in NW Montana which identifies a ½ mile radius (MBEWG, 1991, p. 21) around existing occupied and alternate nests in the territory for the period of February 1 through August 31 (MBEWG, 1991, p. 18) to minimize nesting disturbance listed in the recovery plan. The biology and nesting phenology of the bald eagle is consistent within Montana and North Dakota.

- **Black-footed Ferret (Endangered)**

Habitat/Prey - Black-footed ferrets are closely associated with and dependent on prairie dog towns for prey and burrows. The black-tailed prairie dog (Cynomys ludovicianus) is not a Federally listed Threatened or Endangered species. Black-footed ferrets were once present on the Little Missouri National Grassland and in the project area (USFS, Oct. 1986, P. 178). Prior to the site-specific implementation of prairie dog control on Forest Service lands in the 1980's to present, the USFS, in conjunction with the USFWS, conducted black-footed ferret surveys. Black-footed ferrets are not known to occur in the wild in the project area. However, potential habitat is being addressed through the North Dakota Black-footed Ferret Working Group (i.e., interagency group including the USFS) to determine if sufficient habitat exists to support either a wild or reintroduced population of black-footed ferret.

Acreage - The Southern Little Missouri NG portion of the project area currently contains about 59 black-tailed prairie dog towns which total approximately 1,890 acres and are being evaluated as possible areas for black-footed ferret re-introduction sites. The distribution of prairie dog towns was once quite extensive within the boundary of the LMNG (Stewart, 1973, p. 1-t), though data are not available to quantify acreage of prehistoric prairie dog towns.

Prairie Dog - Key Stone Species - Maintenance of prairie dog towns is also assumed to provide for many other wildlife species which live in these habitats such as mountain plover, western burrowing owls (Athene cunicularia hypugea), and swift fox (Vulpes velox). Swift fox den sites are generally located in prairie dog towns; the swift fox is an opportunistic predator (USFWS, Sept. 1990, p. 11).

Historic Distribution - Prairie dogs are thought to have followed major bison migration corridors due to eaten and trampled grassland. Roads and cattle trails were found in 150 of 154 prairie dog colonies examined, colonies were found to be located significantly closer to livestock water developments and homesteads than randomly located points in northeast Montana (Knowles, 1986, p. 198). Historically prairie dog town establishment was favored when pioneers reduced the height of grasses through cultivation and year-long domestic animal grazing in fenced pastures.

Historic Acres on LMNG - On the LMNG acres of prairie dog towns declined from 13,615 in 1939-42, to 997 acres in 1970-72 (Bishop and Culbertson, 1976, p. 219); during the 33-year span there was a 89%

decline in number of towns and a 93% decline in acreage. Poisoning, cultivation and plague were the major factors in declines of acres of prairie dogs as well as reduction in size of towns between past and existing towns.

Existing Distribution - Of the existing 1,890 acres of prairie dog towns in the Southern Little Missouri portion of the project area (Table I-2), 100 per cent of the acres occur on lands acquired through Bankhead-Jones Farm Tenant Act, 1937. Approximately +90 per cent of the NFS lands in the project area were acquired through this Act. The Bankhead-Jones lands generally were cultivated farmlands prior to 1937.

Recent Control Actions - The locations of prairie dog towns were included on the 1986 Custer Forest Map to facilitate recreational shooting of the animals based on the concept of controlling the expansion of, but not to eliminate existing towns (personal communication, C. Glasoe, Forest Service Engineer, May 19, 1993). There have been no control efforts by poison on the Medora R. D. since circa 1990 (personal communication, P. Sjursen, USFS, Feb. 25, 1994)

Monitoring - An accurate estimate of existing prairie dog town acreage is not currently available. A survey using a GPS system is planned for summer 1995 on portions of the Forest which may include the LMNG. The population densities within individual prairie dog towns is unknown at this time.

Landtypes - Historic (1939-42) patterns of 30+ acre prairie dog towns (Bishop and Culbertson, 1976, p. 218) are generally associated with the river/floodplain and badlands landtype association aggregations. The existing distribution of prairie dog towns is thought to be an artifact of past control actions, ownership patterns, and proximity to areas grazed by domestic livestock. Existing prairie dog towns show no clear pattern as to landtype. The existing 1,890 acres of prairie dog towns are present on ten landtypes, though approximately 540 acres (44%) occur on landtypes P3-B and P3-E (Table III-5). Remaining prairie dogs tend to be associated with valley bottoms and terraces.

Management Areas - A total of 880 acres (47%) of prairie dog towns are found in Forest Plan Management Area B (670 A.), C (80 A.), and D (130 A.) (Table I-3). Forest Plan guidelines provide for a total of approximately 3,300 acres of prairie dog towns across the Custer National Forest and 1,000 acres of NFS lands on the Medora Ranger District (Custer Forest Plan, p. 20). These acreages have not been disaggregated to the project area. Forest Plan guidelines were developed prior to the delineation of the USFWS prairie dog town complexes and the current Northern Region sensitive species list which now include species dependent on prairie dog town habitat (see Chapter III, C., 3., 4, Sensitive Animal Species, mountain plover).

Existing Road Impacts - Approximately 80 acres (4%) of the existing 1,890 acres of occupied prairie dog town habitat are currently directly impacted by existing roads (Table I-2). Of these 80 acres, essentially all acres are within inventoried prairie dog complex areas. Of the 40 acres of existing road impacts, 40 acres are on private surface ownership and 40 acres on NFS lands. Impacts assume 100 feet from the centerline on each side of a road (Forest Plan, USFS 1986, p. 160). Additional direct mortality occasionally results from vehicles on roads running over prairie dogs in situations where roads are immediately adjacent to prairie dog towns. The later direct mortality has affected individual animals, but not populations or acres of prairie dog town.

Assumptions - It is assumed that indirect adverse impacts from roads extend out ¼ mile (0.16 km) when roads are in or adjacent to prairie dog towns. The presence of roads may influence future introductions of black-footed ferrets. Roads open to motor vehicle traffic can serve as an avenue to diseases directly impacting the black-footed ferret. Alien plants can be introduced along roads, replace native plants, and indirectly affect potential black-footed ferret habitat as well as other species dependent on prairie dog towns.

Competitors/Predators - Ungulates compete to some degree for herbaceous plants, however, ungulates also lower the average height of vegetation and help provide suitable habitat for prairie dog establishment and migration. The existence of cattle point attractants (water tanks and supplemental feed sites) may

encourage prairie dog colonization (Licht and Sanchez, 1993, p. 385 - 386). Raptors, coyotes, and foxes are attracted to prairie dog towns where they prey on prairie dogs and other wildlife associated with prairie dog towns. Changes in the abundance of prey species can result in corresponding changes in predator populations. Some of these predators may also prey on black-footed ferrets.

Disease - Diseases can potentially influence black-footed ferrets directly and indirectly. People entering an area by motor vehicle frequently bring domestic dogs as passengers. Unvaccinated dogs may carry the disease canine distemper which is highly contagious and typically lethal to black-footed ferrets. Wildlife such as coyote and badger are also susceptible to and can also carry canine distemper. Bubonic plague (Yersinia pestis) is a disease transmitted by flea vectors and found primarily in wild rodents. Plague was probably introduced to the U.S. from Asia circa 1899 (Cully, J.F., Jr., 1989, p. 48). Plague was confirmed in 1993 at the South Unit of Theodore Roosevelt National Park, but no die-off of prairie dogs was reported. North Dakota is a relatively plague-free state and has not been subject to the same plague problems as eastern Montana experienced in recent years (Medlin, J. A. Dec. 8, 1993).

Cedar River

There are no existing prairie dog towns on the Cedar River National Grassland (personal communication, Forest Morin, District Ranger, April 16, 1993).

TABLE I-2

Acres of Black-tailed Prairie Dog Towns by Land Ownership [1]

Ownership	Acres	Impacted acres within 100 feet of Road/Pad	Net Acres Remaining
Private	960 (51%)	40 (50%)	920 (51%)
State	50 (2%)	0 (0%)	50 (0%)
NFS lands	880 (47%)	40 (50%)	840 (46%)
Total	1890 (100%)	80 (100%)	1810 (100%)
% Habitat	100%	4%	96%

[1] Unbuffered acres based on output from GIS data base Dec. 28, 1994.

TABLE I-3

Acres of Black-tailed Prairie Dog Towns by Management Area on NFS Lands [1]

Management Area	Acres	Impacted acres within 100 feet of Road/Pad	Net Acres Remaining
B	670 (76%)	20	650 (77%)
C	80 (9%)	0	80 (9%)
D	130 (15%)	20	110 (14%)
Total	880 (100%)	40	840 (100%)
% Habitat	100%	5%	95%

[1] Unbuffered acres based on output from GIS data base Dec. 28, 1994.

- **Gray Wolf (Endangered)**

The gray wolf (Canis lupus) has been detected in north eastern North Dakota east of the Missouri River, and at the north end of the LMNG, but is not known nor suspected to occur in or immediately adjacent to the project area. The species will not be considered further in this analysis.

- **Interior Least Tern (Endangered)**

The interior least tern (Sterna antillarum) nests along mid-stream sandbars of the Missouri and Yellowstone Rivers. There are no known nest records for the Little Missouri River or other areas of the project area. The Cedar River and tributaries to the Little Missouri River are considered unsuitable nest habitat.

- **Peregrine Falcon (Endangered)**

The peregrine falcon (Falco peregrinus) migrates during the spring and fall statewide, but primarily along major river courses such as the Little Missouri River. Historic nesting has been recorded in the badlands, however, there are no known nest sites in or immediately adjacent to the project area. The Forest Plan (USFS, Oct. 1986, p. 19 and 172) lists a 1/4 mile radius around nest sites to avoid disturbance during the period March 15 to July 20, which is inconsistent with the 1.0 mile radius (USFWS, 1984, p. 34) and period of February 1 through August 31 (USFWS, 1984, p. 21) listed in the recovery plan.

- **Whooping Crane (Endangered)**

Whooping crane (Grus americana) migrate through the west central counties of ND during spring and fall. These crane prefer to roost on wetlands and stock dams which provide good visibility of the surrounding area. Young adults have summered in North Dakota in 1989 to 1990. No sightings of whooping cranes are known from the project area. There are no known concentration areas for sandhill cranes (Grus canadensis) which would indicate potential habitat for whooping cranes within the project area.

- **Pallid Sturgeon (Endangered)**

The pallid sturgeon (Scaphirhynchus albus) is not known or suspected to be present in the Little Missouri River nor other streams contained in or immediately adjacent to the project area, and will not be carried forward in analysis.

- **Piping Plover (Threatened)**

The piping plover (Charadrius melodus) nests on mid-stream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. There are less than 2,500 of these birds left in the world and alkali lakes in North Dakota are home to over 800 (Grondahl, 1988, p. 13). Likely factors limiting the population in North Dakota include are nest predation and habitat availability (Gaines and Ryan, 1988, p. 266). In the project area potential nest habitat exists along the Little Missouri River; tributaries are considered unsuitable habitat. There are no large saline wetlands suitable for piping plover nest habitat in the project area. No breeding birds or nests have been detected in the project area.

- **Other T and E Species**

There are no known occurrences in the project area of other animals or plants classified as Threatened, Endangered, or proposed for listing under the Endangered Species Act of 1973 (Sapa, April 22, 1992, and personal communication Roger Collins, USFWS, Dec. 7, 1993 and March 14, 1995).

III. EFFECTS OF IMPLEMENTATION OF THE PREFERRED ALTERNATIVE

The BLM/Forest Service preferred alternative is Alternative E-7 as modified by the required mitigation. Alternative E-7 proposes to lease approximately 255,700 acres of Federal minerals. An upper estimate of 21 wells (range 14-21) could be drilled and approximately 12.6 miles of road (0.6 miles/well) could be constructed under the RFD scenario. Alternative E-7 includes lease stipulations to minimize or avoid impacts to natural resources.

IV. DETERMINATION OF EFFECT

- **Bald Eagle**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative 7 would result in **"No Effect"** on bald eagles within the project area.

Rational for Effect Determination - The Southern Little Missouri River system is considered marginal and the remainder of the project area unsuitable for bald eagle nest habitat. The project area contains a limited distribution of surface water and associated suitable bald eagle prey such as fish or waterfowl. Sporadic winter use has been documented within the project area, but no historic or active nests or communal winter roosts are suspected nor known.

A lease noticed would be applied to which requires a detailed survey at the time an Application of Permit to Drill (APD) is received. The intent would be to determine the extent habitats are used by bald eagles. Guidelines in the Bald Eagle Recovery Plan would be followed in the event a nest sites or communal winter roost is identified.

Give the aforementioned Lease Notice and survey requirements, it is anticipated that oil and gas activities will result in no effect to the bald eagle or its habitat under Alternative E-7.

- **Black-footed Ferret**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative E-7 would result in **"Not likely to adversely affect"** on black-footed ferret within the project area.

Rational for Effect Determination - The habitat, limiting factors, habitat model, assumptions, and supporting references described in Chapter III under this sub-issue were used as a basis for determining effects of alternatives [Chap III, C., 3., b., 2), Black-footed Ferret Habitat/Prairie Dog Towns]. The pad location is addressed under stipulations and all other oil and gas associated activities (roads, off-site storage tanks, pipelines, powerlines) are addressed under the Forest Plan.

Acreages of prairie dog towns differ between Chapter III and IV. Acreages previously shown in Chapter III were for actual acres of prairie dog towns; acreages shown in Chapter IV reflect the prairie dog towns and 100 feet buffered area around the perimeter of towns.

Mitigation Measures Applicable to Alternatives E-7 - Alternative E-7 would protect the habitat within a 100 feet radius (Forest Plan) of existing towns from vegetation disturbance year long by NSO (No Surface Occupancy). As no access would be permitted in the area, no facilities would be installed and therefore there would be no direct or indirect effects from oil and gas activities associated with development and production within 100 feet radius of the towns. Impacts could occur to new acres of prairie dog towns occupied between the time the lease offered and initiation of activities associated with oil and gas activities within 100 feet of the area delineated at the time the lease is issued. The lease holder has up to ten years to initiate exploration, and in the event of development and production could extend up to 50 years. No protection would be provided for prairie dog towns that expand over 200 meters (SLT) beyond perimeter of mapped habitat

Effects of Alternative E-7 - There is essentially no probability of H2S releases directly impacting animals in prairie dog towns given the low potential from the Tyler formation. H2S releases in or adjacent to prairie dog towns could result in high mortality to prairie dogs and animals associated with prairie dog towns where suitable geographic basins exist and when winds are low to absent. Mortality to animals in prairie dog towns could approach levels reached by plague or past direct poisoning actions. (See discussion on historic records of H2S releases and probability of future occurrence, Chap III/IV, Air Resources).

Trumped Stipulations - The effects of Alternatives E-7 on prairie dog towns based on trumped stipulations of NSO = 1,230 A. Based on landownership, it is assumed that 49 per cent of these effects could occur on lands in Federal mineral estate.

Alternative E-7 (FEIS preferred) would result in a of 100 per cent NSO (1,180 A.) of occupied habitat and would protect existing prairie dog towns from impacts of road, pad, and facilities associated with oil and gas activities associated with exploration, development, and production. Approximately 0 wells would be drilled on Federal mineral ownership under the RFD scenario which could impact the species or habitat.

Cumulative Effects - The black-footed ferret habitat/prairie dog town cumulative effects boundary is the same as the project area.

Past Actions - The past actions were previously described on in this Appendix. Activities associated with roads within 100 feet of prairie dog towns on all ownerships have potentially resulted 8 per cent (100 A.) of 1,140 acres (unbuffered) prairie dog towns (EIS Table I-2) and 10 per cent (80 A.) on NFS lands (surface ownership) (Table I-3). Acreages by mineral ownership were previously discussed (EIS Table IV-13).

Present Actions - Recreational shooting of prairie dogs is permitted under existing state laws by the NDGFD. The existing level of shooting prairie dogs has temporarily reduce animal numbers and densities in some locations, but as habitat remains intact has not reduced over all prairie dog town acres. In general, prairie dog towns have remained the same acreage or expanded slightly under existing shooting induced mortality.

The non-oil and gas related past activities permitted under the Forest Plan or ongoing on private lands as discussed in Chapter III under existing condition would generally continue under present actions.

Present oil and gas related actions were included as an increment within the RFD scenario. Under the RFD scenario approximately 49 per cent of the following impacts are assumed to occur on Federal lands. Under the RFD scenario several potential wells are located within a 100 feet radius of prairie dog towns. There are 2 wells within a 100 feet radius of prairie dog towns. Approximately 7.5 acres of vegetation would be impacted per well and associated road and it is assumed 5 acres of town would be impacted for each well located within a town. The impacts of wells on prairie dog towns within a 100 feet radius of prairie dog towns from all phases of oil and gas activities for Alternative E-7 is 0 wells/0 acres. If oil and gas development and production occurs disturbance could result for all habitat currently protected only by TL.

Reasonably Foreseeable Actions - Oil and gas related activities on private as well as existing Federal leases are considered as part of the RFD scenario. Oil and gas related activities are estimated to extend 25 years, but could potentially extend up to 50 years. Activities associated with non-oil and gas related activities such as farming, ranching, and dispersed and developed recreation have not been projected in a model. Therefore, in the absence of a model these non-oil and gas related activities are estimated and assumed to increase slightly in the future, and to total an additional 1 per cent (20 acres) impact from roads within 100 feet of prairie dog towns.

Effects from Federal actions could include impacts from oil and gas related activities in existing leases; these actions could be positive in cases where tall vegetation is removed outside of prairie dog towns which improves migration of individual animals or town expansion. These activities could also be negative in cases where direct mortality results as from roads or pads being constructed in prairie dog towns or as a result of motor vehicles driving over prairie dogs on roads.

Non-Federal actions could occur on private lands and fragment the existing prairie dog town complex as well as reduce the acreage of individual prairie dog towns. These actions could include control action on the part of private land owners as well as oil and gas related activities on private lands. Recreational shooting of prairie dogs could also continue in the absence of any NDGFD restrictions; shooting of individuals may temporarily reduce numbers, but is not expected to reduce over all prairie dog town acres.

In summary, the cumulative effects of Alternative E-7, considering the acreage, spacial, and temporal effects of oil and gas related activities and other permitted resource activities on existing prairie dog towns are not likely to adversely affect black-footed ferret habitat.

- **Gray Wolf**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative 7 would result in **"No Effect"** on gray wolf within the project area.

Rational for Effect Determination - The gray wolf is not present in the project area. There are no specific stipulations for the gray wolf or potential habitat. Stipulations for habitat protection of big game species (potential prey species) would provide for potential gray wolf habitat.

- **Interior Least Tern**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative 7 would result in **"No Effect"** on interior least tern within the project area.

Rational for Effect Determination - There are no specific stipulations for the interior least tern. Bank and mid-stream sandbar habitat for interior least tern is considered and protected through stipulations for the Little Missouri River, Executive Order No. 11988, Flood Plain Management, and issuance of 404 permits.

Alternative E-1, E-2, and E-6, would be NL; E-3 and E-7 -preferred (NSO), and E-4 (CSU). E-5 (SLT) would have no impact because the Corp of Engineers would review the lease and the leasee would be required to obtain a 404 permit from the Corp of Engineers to access the river bed. Executive Order No. 11988, Flood Plain Management, would apply. See discussion in FEIS, P. D-19. The ESA would also apply to issuance of 404 permits. There would be no effect to potential interior least tern habitat in the Little Missouri River under Alternatives E-7.

- **Peregrine Falcon**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative 7 would result in **"No Effect"** on peregrine falcon within the project area.

Rational for Effect Determination - In the absence of nesting peregrine falcons, any suitable eyrie would tend to be occupied by either nesting prairie falcons or golden eagles for which stipulations would be applied to protect the latter species. The stipulations for Alternative E-7 for prairie falcons or golden eagles would match the radius around nests listed in the peregrine falcon recovery plan.

A lease noticed would be applied to which requires a detailed survey at the time an Application of Permit to Drill (APD) is received. The intent would be to determine the extent habitats are used by bald eagles. Guidelines in the Peregrine Falcon Recovery Plan would be followed in the event a nest site is identified (USFWS, 1984).

Give the aforementioned Lease Notice and survey requirements, it is anticipated that oil and gas activities Alternative E-7 will have no affect on the peregrine falcon or its habitat.

- **Whooping Crane**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative 7 would result in **"No Effect"** on whooping crane within the project area.

Rational for Effect Determination - Whooping cranes are not known to utilize the project area. Potential habitat would be protected by Executive Order No. 11990, Protection of Wetlands. The Corp of Engineers with consideration of the ESA, would review any proposed activity in a wetland before issuing a 404 permit to the lease holder to enter and occupy a wetland area. Therefore, there would be no effect to whooping crane or potential habitat under Alternative E-7.

- **Piping Plover**

Determination of Effect - Based on our current knowledge, the actions proposed under Alternative 7 would result in **"No effect"** on piping plover within the project area.

Rational for Effect Determination - Stipulations protecting the Little Missouri River as previously discussed under interior least tern would also apply for piping plover habitat along the Little Missouri River and the shorelines of saline wetlands would be covered by Executive Order No. 11990, Protection of Wetlands. The Corp of Engineers with consideration of the ESA, would review any proposed activity in a wetland before

issuing a 404 permit to the lease holder to enter and occupy a wetland area. Therefore, there would be no effect to the habitat of the interior least tern under Alternative E-7.

Table I-4 displays the summary of biological determinations made on the effects of the Alternative E-7 (preferred) on Federally listed Endangered and Threatened species.

TABLE I-4

Summary of Determination of Effect on Endangered or Threatened Species for Alternative E-7 (FEIS preferred)

Species [1]	Status	Determination of Effect [2]
Bald eagle	Endangered	"No effect"
Black-footed ferret	Endangered	"Not likely to adversely affect"
Gray wolf	Endangered	"No effect"
Interior least tern	Endangered	"No effect"
Peregrine falcon	Endangered	"No effect"
Whooping crane	Endangered	"No effect"
Piping Plover	Threatened	"No effect"
Pallid sturgeon	Endangered	"No effect"

[1]Identified in coordination with USFWS (Sapa, April 22, 1992; Collins, December 7, 1993; Collins, March 14, 1995).
[2] Options in determination of effects: No effect; Not likely to adversely affect; Likely to adversely affect; or Beneficial effect.

V. RECOMMENDATIONS FOR REMOVING, AVOIDING, OR COMPENSATING ADVERSE EFFECTS

Black-footed Ferret Habitat/Prairie Dog Towns

Any effects of Alternative E-7 could be mitigated by a net reduction in roads and areas open to motor vehicle traffic under the Forest Plan by way of Forest Orders (see Custer Forest Plan, P. 36). The degree of mitigation would generally be consistent with the change in unroaded habitat around prairie dog towns. Specific actions are discussed under Other Mitigation at the end of this section on Biodiversity (Issue 3)

Relocate prairie dog towns to other NFS lands in situations where a prairie dog town would be impacted by a permitted action. Where possible relocate prairie dog towns to a location where it would improve a prairie dog town complex for potential black-footed ferret reintroduction or enhance a corridor of towns between complexes.

VI. CONSULTATION/COORDINATION

A. USF&WS

Allyn J. Sapa
State Supervisor
U.S. Fish and Wildlife Service
1500 E. Capitol Ave.
Bismarck, ND 58501

Wally Jobman, USFWS
Grand Island, Nebraska
(308) 382-6468
(Whooping Cranes)

B. OTHERS

William F. Jensen, Ph.D.
Wildlife Biologist
North Dakota Game & Fish Department
100 North Bismarck Expressway
Bismarck, ND 58501-5095
(Various wildlife species)

LITERATURE CITED

Bishop, N. G., and J. L. Culbertson. 1976. Decline of prairie dog towns in southwestern North Dakota. J. Range Manage. 29(3):217-220.

Collins, R. March 14, 1995. FAX of list of Federal Threatened, Endangered and candidate species found in North Dakota, November 1994. To: Don Sasse, USFS, Custer N.F., Billings, MT, From: Roger Collins, USFWS, Bismarck, ND. 2 pp.

Collins, R. December 7, 1993. Personal communication to D. Sasse confirming USFWS species list.

Cully, J. F., Jr. 1989. Plague in prairie dog ecosystems; importance for black-footed ferret management. pp. 47-55, In: Clark, T. W., D. Hinckley, and T. Rich. 1989. The prairie dog ecosystem: managing for biological diversity. Montana BLM Wildlife Technical Bulletin No. 2, August 1989., Billings, MT, 55 pp.

Gaines, E.P., and M.R. Ryan. 1988. Piping plover habitat use and reproductive success in North Dakota. J. Wildl. Manage. 52(2): 266-273.

Grondahl, C.D. 1988. Piping plovers,onion cups, and the drought of '88. North Dakota Outdoors. June. 51(4): 12-14.

Knowles, C. J. 1986. Some relationships of black-tailed prairie dogs to livestock grazing. Great Basin Naturalist. 46(2): 198-203.

Licht D.S., and K.D. Sanchez. April, 1993. Association of black-tailed prairie dog colonies with cattle point attractants in the Northern Great Plains; Great Basin Naturalist 53(4). p. 385-386

MBEWG. 1991. Habitat Management Guide for Bald Eagle in Northwestern Montana, Montana Bald Eagle Working Group, 29 pp.

Medlin, J.A. Dec. 8, 1993. Letter to R. Richardson, Acting Forest Supervisor, Custer N. F., From USFWS, Ecological Services, Bismarck, ND State Office, regarding clarification on prairie dog towns and potential black-footed ferret reintroduction areas. 2 pp.

Sapa, A. J. April 22, 1992. Letter to C. W. Bates, Forest Supervisor, Custer N. F., From USFWS ND State Office, regarding USFS requested list of Federally listed threatened and endangered species. 4 pp.

Stewart, R. E., Jr. (Ed.). 1973. Little Missouri Grasslands Study, southwestern North Dakota. Intermim Report No. 6, Conference on Resources of Southwestern North Dakota, Dickinson State College, July 10, 1973. 95pp.

USFS. October 1986. Custer National Forest Final Environmental Impact Statement (October 1986), pps. 125, 191-196

USFWS, 1984. American peregrine falcon recovery plan (Rocky Mountain/Southwest Population). Prepared in cooperation with the American Peregrine Falcon Recovery Team. USFWS, Denver, CO. 105 pp.

USFWS. Sept. 1990. Report on the status of the swift fox, Vulpes velox, a category 2 taxon, in North Dakota. USFWS, Fish and Wildlife Enhancement, Bismarck, ND. 18 pp.

APPENDIX J

BIOLOGICAL EVALUATION
USFS NORTHERN REGION SENSITIVE SPECIES

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

NOTE TO READERS

The Biological Evaluation was **incorporated into the text of the chapters** contained in this EIS based on recent direction [personal communication, R. Escano, (USFS W.O., T&E) and B. Rudediger (USFS R-1, T&E), May 26, 1994]. The Biological Evaluation includes the discussion and references under:

Chapter III (Affected Environment), C. Issues, 3. Biodiversity (Issue 3), 3) Sensitive Animal Species, and 4) Sensitive Plants.

Chapter IV (Environmental Consequences), C. Issues, 3. Biodiversity (Issue 3), 3) Sensitive Animal Species, and 4) Sensitive Plants. The determination of effects by "E" or leasing Alternatives are discussed in the text by individual species and summarized in **Table IV-15A (Animal)** and **Table IV-22A (Sensitive Plants)**.

March 1995

APPENDIX K

MANAGEMENT INDICATOR SPECIES
(U.S. Forest Service)

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

PREPARED BY

DONALD C. SASSE, Wildlife Biologist
Custer National Forest

June, 1994

APPENDIX K

Management Indicator Species

I. Introduction

The purpose of this appendix is to document how management indicator species (MIS) not discussed elsewhere in the EIS were considered in the analysis.

II. Endangered and Threatened Species

There are no **grizzly bears** (*Ursus arctos*) in the Little Missouri National Grasslands (LMNG) - see range maps (Reel, et al, 1989). The project area and the LMNG are outside of any recovery zone for the grizzly bear.

Range maps shown in Reel, et al. (1989) do not show the **gray wolf** (Canis lupus) as occurring in the LMNG.

III. Northern Region Sensitive Species

The **Townsend's big-eared bat** (Plecotus townsendii) typically uses caves or abandoned mine shafts for roost sites, hibernation, and nursery areas (Reel et al., 1989). During the summer, they are found in a wide variety of forest communities including moist, high elevation, mixed conifer types. The Townsend's big-eared bat uses caves, mining tunnels, and abandoned buildings as summer roost sites. They feed at night, mostly on moths, along forest edges. There were no known caves nor abandoned mines within the project area, however, abandoned buildings are present. Townsend's big-eared bat is known to occur in the eastern Montana, but is absent from North Dakota (Reel, et. al. 1989), though no surveys have been conducted in the project area.

Townsend's big-eared bat, the **spotted bat** (Euderma maculatum), and **pallid bat** (Antrozous pallidus) are not known to occur in North Dakota (personal communication, Dr. Robert Seabloom, UND, May 25, 1993).

The **harlequin duck** (*Histrionicus histrionicus*) is not known to nest in or near the project area based on range maps (Reel, et al, 1989). There is no potentially suitable nesting habitat within the project area.

The **flammulated owl** (Otus flammeolus) was considered. The ponderosa pine habitat found within the project area is believed to be inadequate habitat for flammulated owls. The project area contains a disjunct island of ponderosa pine forest. Flammulated owls are not know to have been present either historically or in recent times within at least a one mile boundary surrounding the administrative boundary of the Little Missouri National Grasslands (personal communication, telephone call by Gary Foli, to Randy Kriel, NDGFD non-game coordinator; ND Natural Heritage Program had no data, March 10, 1993). Ponderosa pine trees within the project area are essentially all less than 12 inch in diameter, short in height, and insufficient to physically provide for this owl which is a secondary user of tree cavities. Distribution maps (Reynolds et al, 1987, p. 137) show the flammulated owl to be west of the continental divide in Montana. Reynolds et al (1987) states that the owl inhabits the ponderosa pine communities from the lower elevations to the upper elevations where the Pine grades into Douglas-fir, larch, or aspen. With the exception of one nest in California, all reported nests have been in stands containing at least some ponderosa pine mixed with one or more of the above mentioned species. All nest were in or adjacent to old growth stands. The owl is insectivorous in its diet and it appears that old growth ponderosa pine/Douglas fir stands provide for a more open canopy more suitable for hawking and more abundant prey (Reynolds et al 1987).

The **fisher** (Martes pennanti) is not known to inhabit the LMNG. Extensive acreage of mature forest found in occupied habitat in other areas of the west are absent from the LMNG.

Several other Sensitive wildlife species are listed as occurring in in R-1 [**Trumpeter swan** (Cygnus buccinator), **spotted bat** (Euderma maculatum), **common loon** (Galvia immer), and **Coeur d'Alene salamander** (Plethodon

vandykei idahoensis), and **Northern bog lemming** (Synaptomys borealis), **Lynx** (Felis lynx), **black-backed woodpecker** (Picoides arcticus), **boreal owl** (Aegolius funereus), and **white-tailed prarie dog** (Cynomys leucurus)], but based on range maps in Reel, et al, (1989) the species does not occur in or near the LMNG or Cedar River National Grassland (CRNG)portion of the project area.

IV. Habitat Indicator List (Forest Plan P. 18)

The **goshawk** (Accipiter gentilis) is the old growth MIS. Goshawks are not known or suspected to nest in the project area. The height, diameter, crown cover, and acreage are believed to be inadequate to constitute suitable nesting habitat for goshawks.

Ruffed grouse (Bonasa umbellus) - no aspen or alder habitat in the project area.

Prairie chicken (Tympanuchus cupido) - not present in the project area.

LITERATURE CITED

Reel, S., L. Schassberger, and W. Ruediger. 1989. Caring for our natural community: Region 1 - Threatened, Endangered, and Sensitive Species Program, USDA, USFS, R-1, 309 pp.

Reynolds, Richard T., Ronald A. Ryder, Brian D. Linkhart, 1987. Small Forest Owls, in Proc. of Western Raptor Mgmt Symp and Wksp: 26-28 Oct, Boise, Id. Wash DC: National Wildlife Fed, 1989 National Wildlife Fed scientific & technical series no. 12, pages 136-138.

APPENDIX L

PROCESS FOR ANALYZING IMPACTS TO MULE DEER HABITAT

(CANYONLANDS: Issue 3)

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

PREPARED BY

DONALD C. SASSE, Wildlife Biologist
Custer National Forest

Initiated: February, 1993

APPENDIX L

I. BACKGROUND

A. Overview

Mule deer (Odocoileus hemionus hemionus) habitat is strongly correlated with specific topographic and vegetative features referred to here as canyonlands.

The Little Missouri National Grasslands (LMNG) are located in western North Dakota in the Missouri Plateau portion of the Northern Great Plains Physiographic Province. The badlands physiographic sub-division have historically been referred to as the "badland breaks" and contain a mule deer habitat a component described here as canyonlands. Soils throughout the area originated from relatively soft rocks such as clayey shales and sandstones. Soils are generally unstable and highly susceptible to erosion once the vegetative cover is broken or other disturbance occurs.

The majority of badlands breaks in North Dakota occur on the LMNG. The badlands contain a habitat component defined here as canyonlands. These canyonlands include numerous dissected drainages and typically contain woody vegetation along perennial, intermittent, and ephemeral streams. The woody vegetation along these washes and arroyos supports higher mule deer numbers that the surrounding grasslands, and provide important habitat for other forms of wildlife (e.g., nesting sites for neotropical migrant birds including Management Indicator Species. See USFS, Oct. 1986 p. 18). Mule deer on the LMNG are non-migratory and have a home range of approximately one square mile (640 acres).

Overall mule deer population trends appear to be primarily influenced by winter weather conditions, whereas relative deer numbers within localized areas tend to be influenced by habitat. In recent years overall population trends have been increasing in response to mild winter weather, despite a decline in the quality of the habitat. Human activities associated with increased road construction, energy development, and motor vehicle traffic have reduced the quality of the habitat in portions of the LMNG.

B. Purpose

The purpose of this process is to describe the key habitat elements important to mule deer. Canyonlands are identified as the key mule deer habitat in the LMNG. The canyonlands process defines the terms and related effects analysis methods for the purpose of determining effects on mule deer habitat in the LMNG in North Dakota. The process, assumptions, and variables considered are the product of ongoing cooperation and consensus between North Dakota Fish and Game Department (NDFGD), U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS) wildlife biologists. The definition of terms conform to (Lyon, L. J., and A. G. Christensen. 1992) as modified here to fit mule deer. The process is based on: (1) Jensen and Sambor (1992, Dec. 8) which provides a historical summary from the late 1970's to present of NDGFD and USFS discussions on the issue of canyonlands, and (2) a joint meeting held by wildlife biologists on December 9, 1992 and subsequent communications between NDGFD (Bill Jensen), USFWS/USFS (Ken Sanchez) and USFS (Gary Foli, Clint McCarthy, Alan Christensen, and Don Sasse) wildlife biologists. The written process was initiated in February 1993 and has been periodically updated to reflect new information.

C. Relation to Custer Forest Plan

The Forest Planning process addressed the concept of canyonlands and their value to mule deer. The Custer National Forest Management Plan (Forest Plan) addresses the canyonland, i.e., canyon complex, heads of canyons associated with woody draws, concept under Management Area (M.A.) "B" [p. 46, No. 5, b, 2), b), (1)]; M.A. "C" [P.51, No. 5, b, 1)]; M.A. "D" [p. 55, No. 2, b),(1)]; and "E" [P. 59, No. 5, b, 3), b), (1)]. The Forest Plan also addresses canyon complex (p. 169), and Leasing Stipulations (p .169 and p. 170, column 1, paragraph 1) which relates back to the M.A. in the previous reference. The Forest Plan EIS identifies for deer that "... For most of the prairie habitats ... , cover is considered to be the single limiting factor in winter [p .124, d., 2)] and that

"... Several areas on the Little Missouri National Grassland are defined as roadless for the protection of deer, elk, and bighorn sheep. ..." (p. 153, col. 1, para. 1). The effects of oil and gas development on deer are discussed in terms of populations (Forest Plan EIS, p. 186-187, e.). The Forest Transportation System management and motor vehicle access and restrictions were discussed (p. 36-38, II, 11). The Forest Plan glossary did not define canyonlands. However, two examples of what constitutes a canyonland complex are given (1986 Custer Forest Plan).

D. Mule Deer Habitat

According to Severson (1981) "The most extensive badland areas in the Great Plains occur along the little Missouri River in North Dakota and along the White River in northwestern Nebraska and South Dakota." Broken terrain is escape cover for mule deer because they depend on remaining calm, watching the predator, jumping when attacked and bounding uphill to avoid predators (Geist 1981). The eastern limits of mule deer appear to be related gentle topography and lack of coniferous trees and big sagebrush (Swenson et al. 1983). Mule deer are non-migratory and their winter and summer ranges overlap reflecting an absence of major elevational and respective snow depth gradients in the LMNG.

Canyonlands contain the majority of the brush complex types found in the LMNG. Jensen (1992) reported that feeding radio-collared adult mule deer does selected the brush complex vegetation type significantly more, and avoided grasslands significantly less than expected due to chance. In addition, secondary arroyos (near the heads of drainage systems) were used significantly more than expected due to chance (Jensen 1992).

E. Factors Controlling Mule Deer Populations

1. Weather and Population Trends

In general mule deer numbers tend to be increasing throughout the LMNG. Severe winter weather has tended to result in periodic declines in mule deer numbers. Hunting mortality, particularly within developed oil fields has also dampened the rate of increase for mule deer on a localized basis. In addition, human disturbance may also have secondary influences upon fawn recruitment within areas with high energy development activity (Fox 1989).

2. Habitat

It is assumed that the needs of mule deer can best be met when there is an overlap of areas relatively free of human disturbance and canyonlands. The application of the canyonlands model is an art based on best available information and professional judgement of wildlife biologists. The process is typically applied at a landscape level involving areas usually over 10,000 acre in size. Knue (1991) points out that management efforts for mule deer are directed at keeping the herd within the carrying capacity of the range and providing sustained surplus for recreation.

3. Population Structure in High Verses Low Oil and Gas Development Areas.

Oil and gas development has increased the density of all-season roads and indirectly resulted in a change in mule deer age structure and sex ratios. Jensen (1991, June 5) showed that areas with major oil development and high road densities had a younger female mule deer age structure than those areas with low energy development (mean age for high and low development areas were 3.4 and 6.1, respectively). Differences in age structure between high and low areas of energy development are presumably due to variations in hunting pressure and access. Hunters with doe permits apparently focus on energy development areas containing high open road densities to fill their license. Conversely, those hunters with buck permits will initially concentrate their efforts on the more remote roadless areas where overall deer densities are higher. Based on fall aerial surveys, mean sex ratios for low and high energy development areas were 0.31 and 0.65 bucks per doe, respectively. The apparent increased hunting mortality on does inflates the sex ratio. The overall sex ratio for the badlands was 0.38 bucks per doe during this period.

F. Overlap with Selected Plant and Animal Habitats

The delineation of canyonlands areas permits a quantitative comparison of overlap with habitats of plants and other animals. Wildlife biologists have felt that intuitively canyonlands in the Little Missouri National Grasslands contain habitat for many species in addition to mule deer, e.g., raptors, neotropical migrant birds, and uncommon plant communities. The green ash plant communities cover approximately 3% of the LMNG (personal communication, Bill Jensen, NDGFD, March 23, 1994). Canyonlands polygons were compared to, and data displayed quantitatively for the following: raptors nests including ferruginous hawks, golden eagles and prairie falcons; sensitive plant populations; woody draws as habitat for neotropical migrant birds; and California bighorn sheep.

II. DEFINITIONS AND DISCUSSION (What are they?)

A. Canyonland Delineation (Habitat)

CANYONLANDS are associated with perennial, intermittent, and ephemeral streams located in the eroded and incised drainages found primarily within a corridor along the Little Missouri River within the Little Missouri National Grasslands. Canyonlands are defined quantitatively according to the following criteria.

Length: The minimum length of a canyonland is 1,320 feet as measured on a USGS quadrangle map (1:24,000 or 2.64 in/mile scale) from the mouth of the stream to the upper head waters.
Width: The width, usually measured at the mouth of the stream course, must be 2,000 feet or less with a height of at least 100 feet on both sides of the canyonland.
Flat Stream bottoms: Canyonlands must contain a relatively flat bottom with at least a 40 foot change in elevation as measured within a 1,000 foot wide corridor at the bottom of the canyon and perpendicular to the stream.
Width and height requirement: The width and height requirement was considered met when it included more than 20% of the total length of the canyon. For example, if the total length of the canyon is 3,000 feet and the height is 100 feet for 500 feet (17%) and 60 feet for the remaining 2,500 feet (83%) the canyon was not delineated.
Vegetation: Canyonlands must contain trees or shrub type vegetation which occupy at least 5% of the stream drainage. Northerly slopes associated with canyonlands retain relatively more moisture and are capable of supporting trees and shrubs forming greater vertical structure diversity of vegetation than the relatively flat surrounding rolling prairie topography. Juniper stem density and basal area values were highest on northwest facing slopes (Jensen 1988). Green ash stands usually occurred on gradual slopes with a northeastern orientation (Jensen 1988). Percent species composition of total graminoids in the brush complex vegetation types sampled was highest on south to southwest slopes (Jensen 1988). Percent species composition of total shrubs in the brush complex vegetation types sampled was also highest on slopes with a northerly aspect and in arroyos (Jensen 1988).
Polygons: Each canyonland polygon was identified independently of canyonlands located in adjacent drainages to permit analysis by sub-drainage. In cases where two canyonland polygons shared the same adjacent boundary the information was digitized from each side of the line to provide separate polygons in GIS.

B. Woody Draws

WOODY DRAWS are defined as "A classification of areas, particularly in grassland settings, where an overstory of woody vegetation in small drainages creates habitat for many wildlife species and shade/wind protection and forage for livestock. The vegetation is a result of higher moisture conditions than in the surrounding area but surface water if any, running thru the area is generally short term" (Custer Forest Plan).

Discussion: Woody vegetation includes shrubs such as western snowberry (Symphoricarpus occidentalis), silver buffaloberry (Shepherdia argentea), chokecherry (Prunus virginiana), skunkbrush (Rhus trilobata) and serviceberry (Amelanchier alnifolia). Tree species includes green ash (Fraxinus pennsylvanica), boxelder (Acer negundo), American elm (Ulmus americana), cottonwood (Populus deltoides), and juniper (Juniper scopulorum, J. communis). In general, the shrub and tree vegetation is associated with northerly slopes and higher moisture regimens that are found in surrounding relatively flat topography (Jensen, 1988). Woody draws in the rolling prairie tend to be on rangelands near water developments where relatively heavy livestock grazing occurs compared to the step incised drainages in the canyonlands portion of the badlands.

Custer Forest Plan Amendment No. 13, October 24, 1991, states that for woody draws (Management Area N), "When new leases are processed, this management area is to be leased with a No Surface Occupancy stipulation."

D. Areas of Disturbance (oil and gas activities/non-hunting disturbance)

Two types of areas were defined, mapped, and quantified for the purposes of analysis.

Areas of Disturbance - Areas where sufficient human disturbing activities occur to cause animals to move to an area of suitable habitat where no or low levels of disturbing activity occurs.

Areas of Refuge - Areas where animals move to after leaving areas of disturbance.

III. PROCESS FOR DELINEATING CANYONLANDS (How were they identified?)

A. Mapping Canyonlands

CANYONLANDS were mapped by USFS wildlife biologists and validated by NDGFD wildlife biologists according to criteria in the definition and delineated on clear acetate overlays of USGS 7.5-minute topographical maps (scale 1:24,000). Knowledge of the area, field verification, or recent aerial photographs (scale 1:24,000) were used to verify the type and extent of shrubs and trees forming the WOODY DRAWS in the area.

B. GIS Themes

Canyon complexes were developed as a theme within the Geographic Information System (GIS), digitized, and data loaded into a MOSS software program. The GIS Canyonlands theme was then interfaced with other themes, when data was available, including vegetation, slope, ownership, oil and gas leases, well pads, pipelines, roads, and water developments to determine the impacted and unimpacted habitats, and connectivity and fragmentation between these habitats. The evaluation of connectivity and fragmentation included consideration of vegetation, roads, pipeline corridors, and oil/gas wells. The process of evaluating canyonland based on mule deer habitat and human caused disturbance and mortality is addressed under the topic of areas of disturbance.

IV. MULE DEER AREAS OF DISTURBANCE (Oil and Gas Exploration, Development and Production, and Recreation Disturbance)

A. Introduction

The process displays the spatial and temporal arrangement of areas of disturbance and areas of refuge occurring over the next decade within the cumulative effects area which includes the project area. When possible, the information is presented in the form of a table listing and displaying the disturbing activities on a time line, maps displaying the spacial arrangement of areas of disturbance and areas of refuge, and a narrative describing the table and maps. These areas of refuge were developed using the following assumptions and parameters:

B. Assumptions and Parameters

1. Home Range

a. Size: Fox (1989) found that in the North Dakota Badlands the average summer home range for adult female mule deer was from 1.34 (3.46 km^2) to 1.18 square miles (3.05 km^2). Jensen (1988) found that adult females mule deer (N = 12) had an average home range of 410 acres (166 hectares) for summer/fall range. Home ranges tend to be smaller in rough terrain. Male home ranges are larger than females due to breeding activities. For the purposes of analysis of impacts, it is assumed unimpacted fragments smaller than 640 acres (1 square mile) can not accommodate adult female mule deer (personal commuincation, Bill Jensen, NDGFD, Sept. 7, 1993). It is assumed all home ranges are fixed

and do not shift from year-to-year. In general, mule deer numbers in the rough badlands terrain are higher than those found in the more rolling grasslands.

b. Social: There are social limitations to the number of mule deer that can occupy a confined geographic area during the fawning season. Maternal group members space themselves out over the groups collective home range when the fawns are being born and establishing bonds with their mother (i.e., June-July). This segregation of the fawns not only reduces the chance of fawns imprinting on the wrong doe, it may also serve as an antipredation strategy (Jensen 1988). Low ranking does that are unable to fit in between home ranges of does with fawns are likely to disperse from the area (Jensen 1988). This dispersal pattern is commonly found among farmland white-tailed deer (Odocoileus virginianus) in the midwest (Nixon and Hansen, 1992)

2. Disturbance

a. Areas of Disturbance: Areas of disturbance to mule deer are located adjacent to the proposed development areas; they contain spring/summer/fall/winter mule deer habitat of generally similar quality to the areas being disturbed. It is assumed mule deer will either reduce their use or abandon areas where the frequency of human activity reaches a level of nearly continuous disturbance, or the timing of the disturbance is so unpredictable that a pattern can not be established. It is assumed that the degree of habitat loss in the short and long term is related to the number of acres disturbed, to the length of time the disturbance continues, and to the period of years of field operations.

b. Oil and Gas Disturbance: In the absence of hunting, oil and gas activities alone would result in decrease in mule deer feeding efficiency (Fox, 1989; Bill Jensen, July 7, 1993). Disturbance from oil and gas development has been shown to result in reduced mule deer feeding activity during daylight hours. Lactating does need to feed on high quality forage frequently throughout a 24 hour period to maximize milk production for their fawns. This is a critical period for the fawns development and may influence its fitness to survive the following winter.

Unlike white-tailed deer which adapt to man, mule deer tend avoid areas receiving heavy use by man. Mackie and Pac (1980) state that disturbances associated with housing developments on and adjacent to winter ranges can greatly alter, reduce or possibly eliminate deer use of an area. The physical well being, reproductive success and over-winter survival of deer is directly influenced by the extent to which these animals can use all existing winter range and food and cover resources. The presence of domestic animals, especially dogs, in most rural subdivisions accentuates the disturbance effect where those animals are allowed to roam. The unroaded canyonlands are assumed to provide an important refuge to mule deer in that portion of the badlands impacted by energy development.

c. Habitat: Mule deer habitat in the badlands occurs almost entirely as a result of natural topographic and vegetative features. It cannot be constructed or greatly extended by man.

d. Return to Habitat: It is assumed mule deer will return to an area once human disturbance has declined to a negligible level. Time required for the re-establishment of deer to former population levels is dependent upon the size of the disturbed area, distance from adjacent deer populations, and recruitment rates of adjacent populations.

e. Factors Influencing Habitat: Mule deer use of the habitat is complex and is influenced by many factors such as, weather, plant growth, habitat preference, and the effects of cattle, mineral extraction, road construction, recreation use, and oil and gas exploration, production, and development. Oil and gas related activities appear to be the major factor that has the potential to displace mule deer from their home range. Factors affecting big game include the construction of well-maintained roads into previously inaccessible areas which increases pressure from legal hunting and poaching (Stuart, R.W., 1974, as cited in Bromeley, M. 1985, p. 38 and 39)

f. Cover: Areas of refuge may or may not have large blocks of undisturbed canyonlands and grassland. It is assumed that vegetative hiding cover and topographic screening can satisfy day to day needs for

mule deer areas of refuge in the presence of relatively low level and usually non-lethal kinds of disturbance. Cover is assumed to have a more or less random distribution over the landscape, and thus be a minor factor when evaluating the influence of human activity in disturbed areas.

3. Livestock

There is a tendency for mule deer to avoid cattle if they have a choice; see literature review by Mackie (1981) and others on deer-livestock competition (Gallina, 1984; Kie et al. 1991; and Yeo, et al. 1993). If deer don't have a choice they will use the area along with cattle. The presence of cattle makes an area less desirable for mule deer, but does not mean deer will not use the area. Therefore, the general distribution of mule deer in an area of refuge will be inversely proportionate to the amount of active livestock use. The presence of cattle may also result in a less equal distribution of deer if they have a choice of separating spatially from cattle.

4. Roads

a. Seasons of the Year a Road Must be Closed to Motor Vehicle Traffic to Maintain an Area of Refuge: Roads and trails open to motor vehicle travel applies to the June-July fawning period, and deer-gun hunting season at a minimum, and may extend to the year-long period depending on the other factors. The emphasis is on the general deer hunting season (rifle).

b. Distance of Impact: The boundary of areas of disturbance is assumed to be approximately 660 feet (200 meters) from the center line of high use roads open to motor vehicle traffic (Rost and Bailey 1979). It is assumed that roads developed for oil and gas exploration/development will receive high motor vehicle use; high use is defined as over 500 visits per year (Light, J.T. 1971). The 660 feet figure is inclusive enough to consider habitat used by bedding deer of over 338 feet (100 meters) from energy production facilities (Fox, R. A. 1989) and on winter range (Freddy et al. 1986) that preventing locomotor responses by deer would require persons afoot and snowmobiles on winter range to remain at least 191 meters (627 feet) and 133 meters (436 feet) from mule deer, respectively. The 660 feet (200 m) distance is adequate to address impacts of disturbance associated with oil and gas activity on deer productivity and is assumed to be the average maximum effective range "road hunters" could shoot from a road (personal communication, Bill Jensen, Ph.D., NDGFD, August 31, 1993). See IV Glossary for a definition of a high and low impact road.

5. Hunting

a. Hunter Shooting and Access Lanes on Closed Roads Within Canyonland Areas: Consideration was given to the width, alignment, and distribution pattern of roads. The alignment of roads can influence sight distance; the greater the number of twists and turns the shorter the sight distance in badlands topography. There are generally more turns in native surface roads whereas asphalt and aggregate surfaced roads designed by engineers tend to be straighter. The road distribution pattern of closed roads was also evaluated. Canyonland areas with high densities of closed roads in which the physical road surface (road prism) is maintained may increase hunter access by walking and may off set natural unroaded and cover values.

b. Oil and Gas Activities During Hunting Season: Ongoing disturbance from energy activities, recreational viewing from motor vehicles, and hunters driving roads during the hunting season were considered equal in impact to an open road in terms of decrease in areas of refuge for mule deer. Areas of refuge assume no scheduled activities (oil and gas exploration, development, production) during the hunting season. If disturbing non-hunting activities occur during the hunting season it is assumed there is a proportional reduction in the area of refuge. Roading into alternating canyonlands would reduce the overall affect on the population, but not on the individual animal. Jensen (1988) found that individuals tend to stay within a drainage; the edges of plateaus, major roads, and the Little Missouri River tend to define boundaries of mule deer home range. Home ranges tend to be confined within a drainage system.

c. Hunting Traditions: Hunters and outfitters traditional hunting strategies were considered. It is assumed there will be snow-free periods and periods of snow coverage in any part of the season given North Dakota's changing weather conditions. It is assumed hunters will continue the tradition of traveling in all weather conditions given that hunters typically use motorcycles, ATV's, and tire chains on 4-wheel drive vehicles. It is assumed that there will be increased motor vehicle use on open roads and unrestricted areas by hunter and non-hunting recreationists over the next decade as access on private lands becomes increasing limited.

C. Activities Considered

1. Disturbance: Activities considered to result in new widespread disturbance include road construction, mining exploration with heavy equipment, and oil and gas exploration and development. Activities which result in a disturbance, but which are not anticipated to change in intensity or duration include developed recreation sites and residences on adjacent private lands. Several other ongoing low disturbance activities are localized in effect, and are not expected to change in intensity or duration; these activities include administration and permittee management of range allotments, cattle grazing, non-motorized mining exploration, prescribed burning, other special use activities, and non-hunting dispersed recreation use.

2. Spatial and Temporal Duration of Disturbance: Oil and gas development and exploration and associated activities that would disturb and displace mule deer were identified for the cumulative effects area throughout the next decade. When possible, the period of likely disturbance was described in terms of a range of months for each kind of activity.

D. Quantitative Analysis

The analysis was based on the influence of existing, proposed, and reasonably foreseeable roads on delineated canyonlands. The information was quantified in terms of total acres and number of unimpacted and impacted canyonlands assuming the average 660 feet (200 meter) distance out from the center line of roads. The changes in distribution and landscape linkages were displayed on a map and described in a narrative statement.

E. Qualitative Analysis

1. Shape of Mapped Canyonland Polygons: Circular canyonland polygons provide more internal acres of vegetative cover than long thin linear polygons of the same perimeter.

2. Woody Draws: These areas frequently contain full crown trees and which along with topographic relief provide a visual screen to human activity. Woody draws are often mule deer foraging areas in close proximity to vegetative cover and topographic screening. Decisions on including isolated oil and gas exploration/development sites within larger blocks of canyonland were made on a case by case basis and based on professional judgement.

3. Linkages: Canyonland areas of generally 1,000 ft. or greater width were considered in the delineation of linkages. Any deviations from this minimum were described in in Chapter III and IV of the EIS.

4. Distribution of Areas of Refuge: The needs of the non-migratory deer herds are assumed to be met by maintaining a frequent distribution of areas of refuge across the LMNG. The proximity of foraging and bedding areas within canyonlands, and there distribution in relation to refuge areas was considered. It is assumed all home ranges are fixed and do not shift from year-to-year.

5. Percentage in Areas of Refuge: Data are not available to specify a threshold for percent of the area in areas of refuge on the Custer National Forest. Therefore, the following process was used to address the question of what percent of the area needs to be in areas of refuge to hold mule deer in an area during the hunting season.

The existing condition was described in terms of the percent of the canyonland area in areas of disturbance and areas of refuge. NDGFD wildlife biologists were contacted to determine if the written goals and objectives for mule deer were being achieved under the existing condition.

In areas where NDGFD goals or objectives where not currently being achieved, alternatives or mitigation measures were identified to improve the existing situation to fully or impart achieve the Department objectives; these options were recommended and considered in the chapter IV effects analysis portion of the NEPA document. In areas where NDGFD goals or objectives were currently being achieved, it was recommended that as a minimum the existing condition (general distribution and percent in areas of refuge) be maintained. The NDGFD PArticipative MAnagement (PAMA) document (PAMA NDGFD, Aug. 1992) is intended as a planning document. As such, goals and objectives are subject to change over the course of time in response to departmental needs.

6. Private Land - The objective is to maintain areas of refuge on public lands so that mule deer are available for the general public to view, photograph, and hunt. Consideration was given to the influence of activities on adjacent private lands as it relates to areas of disturbance and refuge in the cumulative impact area. Where available, figures on canyonland and road density were displayed for private, state, and NFS lands, and total ownership for the cumulative effects area.

VI. MITIGATION OPTIONS

When a negative impact was identified appropriate mitigation actions were recommended. Consideration was given to the approaches for minimizing the effects of oil and gas development on wildlife as described by Bromeley (1985). Where appropriate, mitigation recommendations were addressed in Chapter IV of the EA/EIS in terms of off setting or beneficial impacts, the relative chance of the mitigation being implemented, the relative success of the implementation, and the relative value of the implementation achieving the desired affect. Mitigation items where also listed under the appropriate alternatives in Chapter II of the EA/EIS.

VII. MONITORING

The results of this analysis will be reported as part of annual Forest Plan Monitoring Report: Wildlife Items, p. 105 - 106, C1 (road construction and oil and gas activities); C3 (deer winter range); C8 (mule deer population trends); Facilities Items, p. 110, L2 (public access); and L3 (road closure and rehabilitation). The results of effects analysis on individual project areas analyzed over the interim period will be reviewed collectively as part of the 10-Year Forest Plan review.

VIII. GLOSSARY

Areas of disturbance - Areas in which human disturbance adversely impacts mule deer.

Biodiversity - Variety of life and its ecological processes. (USFS, 1992)

Corridor - An area through which species can move from one place to another over time in response to changes in environment or as natural parts of their history. (USFS, 1992)

High Impact Road - roads surfaced with asphalt or aggregate (scoria) material.

Linkages - Characteristics of a landscape that provides direct physical connections between two or more places. (USFS, 1992)

Low Impact Road - roads surfaced with native material (non-scoria).

Undisturbed areas - Areas relatively free of human disturbance in regard to mule deer.

LITERATURE CITED

Bromley, M. 1985. Wildlife management implications of petroleum exploration and development in wildland environments. USDA, USFS, General Technical Report INT-191. Ogden, UT. 42 pp.

Fox, R. A. 1989. Mule deer (Odocoileus hemionus) home range and habitat use in a an energy-impacted area of the North Dakota badlands. Grand Forks: Univ. of North Dakota; M.S. Thesis. 88 pp.

Freddy, D. L., W. M. Bronaugh, and M. C. Fowler. 1986. Response of mule deer to disturbance by persons afoot and snowmobiles. Wildlife Society Bulletin 14(1):63-68.

Gallina, S. 1984. Ecological aspects of the coexploitation of deer Odocoileus virginianus and cattle. Acta. Zool. Fennica 172:251-254.

Geist, V. 1981. Behavior: adaptive strategies in mule deer. Pages 157-223 in: Mule and black-tailed deer of North America (O. C. Wallmo, ed.), University of Nebraska Press, Lincoln, 605 pp.

Jensen, W. F. 1988. Summer and fall ecology of mule deer in the North Dakota Badlands. Ph.D. Dissertation, Univ. of North Dakota, Grand Forks. 220 pp.

Jensen, W. F. 1991. Historic frequency of drought in western North Dakota (1406 to 1990). USFS Memo, Medora Ranger District, Custer National Forest, 15 pp.

Jensen, W. F. 1991, June 5. Mule deer and energy development in the North Dakota Badlands. USFS memo, Medora Ranger District, Custer National Forest, 10 pp.

Jensen, W. F. 1992. Mule deer habitat use in the North Dakota Badlands. Prairie Naturalist 24(2): 97-108.

Jensen, W. F., and K. Sambor. 1992 (Dec. 9). History of the canyon lands complex stipulation (1984 to 1992). NDGFD Memo, To: Greg Visconty, U.S. Forest Service, From: Bill Jensen and Ken Sambor, North Dakota Game and Fish Department. 4 pp.

Kie, J. G. C. J. Evans, E. R. Loft, and J. W. Menke. 1991. Foraging behavior by mule deer: the influence of cattle grazing. J. Wildl. Manage. 55(4):665-674.

Knue, J. 1991. Big game in North Dakota: a short history. North Dakota Game and Fish Department. ISBN 0-9621367-4-3. 343 pp.

Lyon, L. J., A. G. Christensen. 1992. A partial glossary of elk management terms. Gen. Tech. Rep. INT-288. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 6 p.

Mackie, R. J. 1981. Interspecific relationships. Pages 487-507 in: Mule and black-tailed deer of North America (O. C. Wallmo, ed.), University of Nebraska Press, Lincoln, 605 pp.

Mackie, R. J., and D. F. Pac. 1980. Deer and subdivisions in the Bridger mountains, Montana. Proceedings Western Association of Fish and Wildlife Agencies. 1980. pp. 517 - 526.

Nixon, *C. M.*, and *L. P.* Hansen. 1992. *Habitat relationships and population dynamics of deer in the intensively farmed midwestern United States.* pp. 22 - 29, ***In: Brown, R. D. 1992.*** The biology of deer. Springer-Verlag, New York. ***596*** pp.

PAMA-NDGFD. August 1992. PAMA: North Dakota Game and Fish Department's Participative Management Process. NDGFD, 100 North Bismarck Expressway, Bismarck, ND, 58501-5095. 140 pp.

Rost, G. R., and J. A. Bailey. 1979. Distribution of mule deer and elk in relation to roads Journal Wildlife Management 43(3):634-641.

Seabloom, R. W., R. A. Fox, and W. F. Jensen. 1987. Mule deer research in the badlands of western North Dakota: 1986 annual summary report to the North Dakota Game and Fish Department, Univ. of North Dakota, Biology Dept.; Annu. Prog. Rep. Pittman Roberson Proj. W-67-R-25.

Severson, K. E. 1981. Plains habitats. Pages 459-485 in: Mule and black-tailed deer of North America (O. C. Wallmo, ed.), University of Nebraska Press, Lincoln, 605 pp.

Stuart, R. W. 1974. Surface mining and wildlife. North Dakota Outdoors. 37(5):2-7.

Swenson, J. E., S. J. Knapp, and H. J. Wentland. 1983. Winter distribution and habitat use by mule deer and white-tailed deer in southeastern Montana. Prairie Naturalist 15(3):97-112.

USFS, Oct. 1986. Custer National Forest Management Plan. USDA, USFS, 186 pp.

USFS, 1992. Our approach to sustaining ecological systems. USDA, USFS, Northern Region, Missoula, MT. R1-92-23. 26 pp.

Wallmo, O. C., L. H. Carpenter, W. L. Regelin, R. B. Gill, and D. L. Baker. 1977. Evaluation of deer habitat on nutritional basis. J. Range Manage. 30(2):122-127.

Yeo, J. J., J. M. Peek, W. T. Wittinger, and C. T. Kvale. 1993. Influence of rest-rotation cattle grazing on mule deer and elk habitat use in east-central Idaho. J. Range Manage. 46: 245-250.

APPENDIX M

ECOSYSTEMS MANAGEMENT

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX M

TABLE M-1

Principal map unit design criteria of ecological units.

ECOLOGICAL UNIT	PRINCIPAL MAP UNIT DESIGN CRITERIA[1]
Domain	• Broad climatic zones or groups (e.g., dry, humid, tropical).
Division	• Regional climatic types (Koppen 1931, Trewartha 1968). • Vegetational affinities (e.g., prairie or forest). • Soil order.
Province	• Dominant potential natural vegetation (Kuchler 1964). • Highlands or mountains with complex vertical climate-vegetation-soil zonation.
Section	• Geomorphic province, geologic age, stratigaphy, lithology. • Regional climatic data. • Phases of soil orders, suborders or great groups. • Potential natural vegetation. • Potential natural communities (PNC) (FSH 2090).
Subsection	• Geomorphic process, surficial geology, lithology. • Phases of soil orders, suborders or great groups. • Subregional climatic data. • PNC--formation or series.
Landtype Association	• Geomorphic process, geologic formation, surficial geology, and elevation. • Phases of soil subgroups, families, or series. • Local climate. • PNC--series, subseries, plant associations.
Landtype	• Landform and topography (elevation, aspect, slope gradient and position). • Phases of soil subgroups, families, or series. • Rock type, geomorphic process. • PNC--plant associations.
Landtype Phase	• Phases of soil families or series. • Landform and slope position. • PNC--plant associations or phases.

[1] It should be noted that the criteria listed are broad categories of environmental and landscape components. The actual classes of components chosen for designing map units depend on the objectives for the map.

Source: USFS, Nov. 5 1993. Reply to: 1330/2060, Subject: National Hierarchical Framework of Ecological Untis, To: Regional Foresters, etc., From D. G. Unger, Acting Chief. 19 pp.

SUBSECTION AND LANDTYPE ASSOCIATION LEGEND
Little Missouri and Ceder River National Grasslands
Revised by Lee McConnel, 12/16/92. 1432 Hrs

There are five Physiographic Subsections represented in the areas mapped to date. This does not split by climatic zone yet. The five subsections are as listed below:

1) A2. The alluvial floodplains of the Little Missouri, Missouri, Cedar, and Cannonball River valleys.

2) P2. Dissected shale and sandstone plains generally above the river valleys.

3) P3. Shale badland areas along the river valleys.

4) P4. Glaciated plains areas which exist only in northern parts of the McKenzie District.

5) P11. Rolling sandstone and shale uplands which are mainly on prairies back away from rivers and significant stream valleys.

LEGEND SYMBOLS AND SHORT DESCRIPTION

The first two symbols represent the Subsection and the symbol(s) following a dash designate(s) the Landtype Association.

1) Subsection A2, Alluvial Floodplains

A2-A Bottomland Association. Only one association has been mapped in this Subsection to date. Ii includes alluvial deposits, some residual footslopes, and residual hills or knobs cut off or nearly cut off by meanders. Another LTA could be described for larger areas of terraces or fans alongside the floodplain. Another possibility would be for riverwash lands and islands in the river.

2) Subsection P2, Dissected Shale and Sandstone Plains

P2-A Floodplains and bottomlands of moderately large drainages flowing through the dissected shale and sandstone plains subsection: These units can include alluvial terraces and fans, entrenched channels, swales, and some remnant hills and knobs within the delineations.

P2-C Weakly dissected residual prairie land: gently rolling, nearly level to somewhat steepened lands with shallow swales and drainageways only a few tens of feet lower than the intervening ridges (interfluves).

P2-D Moderately dissected residual prairie land: Somewhat steeper prairie lands with greater depth of dissection on the order of high tens to perhaps a maximum of 200 feet of vertical relief. Slopes are quite gentle and drainageways are more frequent then in P2-C.

P2-E Strongly dissected lands with rounded residual ridges, steep sideslopes, and deeply entrenched drainageways.

P2-G Strongly dissected mountain slopes around buttes: This land consists of long, steep ridges radiating away from the buttes on all sides. Landforms are steep mountain slopes, sharp ridges, and entrenched channels.

P2-H Plateau, prairie remnant ot stream terrace remnant: This land is similar to unit P3-C but the tops are flatter and there is little entrenchment of drainageways. Soils are developed in either residuum or alluvium. Landform is tableland or mesa.

3) Subsection P3, Shale Badlands

P3-A Floodplains and bottomlands of moderately large drainages flowing through the Badlands Subsection: These units can include alluvial terraces and fans, entrenched channels, swales, and some remnant hills and knobs within the delineated units.

P3-AD Low relief pluvial/fluvial landscape: a complex of somewhat broadened valleys and small hills and buttes which are remnants of a higher-level plain. This unit appears as an old badland which has matured by eroding away most of original plain and depositing material in gently sloping fans and bottoms at the current elevational level which is perhaps 100 to 300 feet below the old plain. Could be called an aggregated badland. Gentle footslopes comprise more than half of the unit and remaining residual ridges and buttes occupy only a small portion.

P3-B Badland Association: Includes such landtypes as streambreaks and upland breaks, flat, rounded, and sharp ridgetops and knobs, colluvial or alluvial fans common at base of badland hills or knobs, steep and unstable slopes, swales, and entrenched channels too small to map as bottoms.

P3-C Weakly Dissected Lands Which are Mostly Remnants of the Prairie: These units exist as islands rising out of the dissected surrounding land. They are mostly composed of gently sloping and rolling prairie ridges, sideslopes, and swales.

P3-D Moderately Dissected Residual Prairie Land: Somewhat steeper prairie lands with greater depth of dissection, on the order of high tens to perhaps a maximum of 200 feet of vertical relief. Slopes are quite gentle and drainageways are more frequent than in P3-C.

P3-E Strongly Dissected Lands: This unit contains a large variety of landforms such as breaks, flat and rounded residual ridges, steep sideslopes, swales, entrenched drainageways, footslopes, terraces and fans, and bottoms. The unit is sometimes mapped between P3-B and P3-C or P3-D where there is a broad transitional zone from one to the other. Ii is also mapped in dissected land similar to badland but where a larger portion of the land has productive soil. Some of these units appear to be old badlands which have recovered to a degree because a stabilized base level has achieved a reduction in downcutting, or perhaps slower degradation had never allowed enough downcutting to develop true badland. These areas are dominated by alluvial slopes or pediments between residual knobs and drainageways.

P3-F If any units still have this symbol, combine them with P3-E.

P3-G Strongly Dissected Mountain Slopes Around Prominent Buttes: This land consists of long, steep, razorback ridges radiating away from the butte on all sides. Landforms are steep mountain slopes, sharp ridges, and V-shaped entranched channels. Only a few units are mapped.

P3-H Plateau, Stream Terrace Remnant: This land appears similar to P3-C but the top is flatter and there is very little entrenchment of drainageways. Soils are developed in alluvium rather than residuum. The landform is almost exclusively flat tableland.

P3-I Association of Plateau Tablelands and Interspersed Badland: Several areas are mapped in order to make appropriately sized map units where the tablelands are long and narrow with narrow incisions of badland separating them. The largest unit is the cliffs plateau area.

4) Subsection P4, Glaciated Plains

P4-A Bottomland Association: Same as in Subsection P3 but may contain glacial material.

P4-B Badland: Includes landtypes as described in P3-B but may contain glacial till material which originally existed on top of the prairie.

P4-C Weakly Dissected Land: Same as P3-C but contains glacial till material.

P4-E Strongly Dissected Land: Same as P3-E but contains glacial till.

P4-K Terraces and Alluvial Fans Lying Above Floodways of Larger Drainages: Likely contain glacial till. May include small areas of other landforms such as breaks and residual ridges existing away from the uplands and surrounded by the depositional lands. Some footslopes which are more like the fans than the residual slope above.

P4-P Hummocky Glacial Till and Potholes: This unit contains areas with poorly-defined and unpredictable drainage patterns. Because of the disorganized pattern of drainageways there are undrained pothole basins, hummocks or knobs, and some drainageways. Quite a bit of this land is cultivated and the original poor drainage has been destroyed or improved according to your viewpoint.

P4-R Strongly Dissected Missouri River Breaklands: This association is similar to P4-E but vertical relief is greater and therefore the canyons are deeper and perhaps steeper.

P4-T Missouri River Terraces: This could likely be considered in Subsection A2 along with the Little Missouri River floodplain but it would be a glaciated variant or phase, and only a narrow remnant lies above high water mark of Lake Sakakawea. I have mapped it as a landtype association in the Glaciated Subsection. It contains some residual footslopes along with the depositional material and some of that has probably been reshaped by waters of the lake.

5) Subsection P11, Rolling Sandstone and Shale Uplands

P11-A Alluvial Floodplains of Streams on Sandstone and Shale Uplands (Prairie): Streams are shallowly entrenched in this unit and landforms include only channels, alluvial bottomland, and some areas of low-lying residual prairie adjacent to the floodway.

P11-B Badland Association: A few areas of badland large enough to delineate exist on the rolling prairie. This unit is designed to accommodate them rather than to include then within prairie lands which differ greatly. They contain typical badland landforms such as residual hills and knobs, steep slopes, alluvial-colluvial deposits as footslopes, and entrenched drainages.

P11-C Weakly Dissected Residual Prairie Land: Gently rolling, nearly level to slightly steepened lands with shallow swales and drainageways only a few tens of feet lower than the ridges.

P11-D Moderately Dissected Residual Prairie Land: Somewhat steeper prairie lands with greater depth of dissection on the order of high tens to perhaps a maximum of 200 feet of vertical relief. Slopes are quite gentle and drainageways are more frequent than in P11-C.

P11-E Strongly Dissected Lands: This land is a little less steep than badland and a smaller portion is actual badland. Much of the unit is dissected residual prairie surface with quite steep slopes which are generally vegetated.

NOTES: Attributes which can be used to describe differences among, and characterize how the lands handle water include: length of and distance between first-order or other low-order channels, drainage pattern such as dendritic, parallel, etc. vertical relief within a unit or from interfluve to interfluve depend on how deep the valleys are entrenched. Shape of the interfluve, such as convex, concave, or straight slopes. This can indicate how the slope handles water, via surface or subsurface flow, and help determine erodability.

TABLE M-2

Species/Habitat by Landtype Associations for NFS lands in the Project Area [1]

Species/ Habitat	A2-A	P2-A	P2-C	P2-D	P2-E	P2-G	P2-H	P3-A	P3-AD	P3-B	P3-C	P3-D	P3-E	P3-F	P3-G	P3-H	P3-I	P11-A	P11-B	P11-C	P11-D	P11-G	P11-E	TO-TALS
Mule deer habitat (Canyon-lands)	67	8		1761	3426	324		274	71	95351	2170	89	28856	1286	417	940	2574	14		144	722	666	1015	140175 A.
Riparian (mapped perenni-al)	4340	440	80	260	40			2010	30	1030	20		350	10		300		1020		210	340	30	10	10530 A.
Prairie Dog	121			99				40	20	264			277			31		57		228	99			1236 A.
Ferrugi-nous hawk			1	12	1	1			1	3									1		6	2		28 N.
Golden eagle	6	2			2	2		1	2	41			20		2		2					5		85 N.
Prairie falcon	1				1	2		2	2	25			3		1							1		38 N.
Sage grouse nest habitat [2]	8480		3140	19960				2080	5940	43510	2100	2420	25800			2870		470		2550	19730		4890	143940 A.
Sharp-tailed grouse nest habitat [3]	2320	700	1440	12460	4270			1490	3300	36910	12910	1580	28670	2540		3560	1690	770		6640	16530		6510	144290 A.
Bighorn sheep	3560							130		29930	30		8180		2400	1640	2230							48100 A.
Sensitive Plants [4]	13	1		4	7	1		1		14		3	8											52[1]
Woody draws	3190	590	1700	3210	730	610		2580	180	11610	1320	50	6210	200	530	590	500	1120		2840	5860	440	860	44920 A.
> 40% slopes																								–

[1] Based on GIS, June, 1994
[2] Potential sage grouse nest habitat within a 2.0 mile radius of leks.
[3] Potential sharp-tailed grouse nest habitat within a 1.0 mile radius of leks.
[4] Three populations occur on landtype associations found only on the Cedar River NG; P3-AB = 2 populations of Eriogonum visheri, and P2-AD = 1 population of Talinum parviflorum.

TABLE M-3

Summary of Landtype Association by Management Area for NFS lands in the Southern Little Missouri NG portion of the Project Area

NFS MA [1]	A2-A	P2-A	P2-C	P2-D	P2-E	P2-G	P3-A	P3-AD	P3-B	P3-C	P3-D	P3-E	P3-F	P3-G	P3-H	P3-I	P11-A	P11-B	P11-C	P11-D	P11-E	P11-G	TOTAL
B	4861	1580	9533	23285	5202	564	2951	5524	49340	10438	2124	31566	658	0	1379	74	1566	0	14177	21633	3306	0	189761
C	15								4171			2269		2010	430	640			12				9547
D	5392				501		1351	538	34085	915		11298			7247	778							62105
E									482			126											608
F									20														20
M																							
N																							
L							30		668														698
Sub-Total:	10268	1580	9533	23285	5703	564	4332	6062	88766	11353	2124	45259	658	2010	9056	1492	1566		14189	21633	3306		262739
State	810	58	205	6154	917		874	1383	12449	1652		6413	435	91	269	307	47		2196	3690		175	38125
Private	21315	3170	14258	62133	14026	2198	8538	8559	100739	20128	377	54204	2106	391	7468	2481	6968	136	47349	87350	7277	3775	474946
TOTAL	32393	4808	23996	91572	20646	2762	13744	16004	201954	33133	2501	105876	3199	2492	16793	4280	8581	136	63734	112673	10583	3950	775810

[1] National Forest System Lands Management Areas

The first letter and number indicate the Subsection represented. The third letter in the code indicates the Landtype Association within the Subsection.

Subsections are:

- A2-__ = Alluvial floodplains
- P2-__ = Dissected shale and sandstone plains
- P3-__ = Shale badland areas along the river valleys
- P11-__ = Rolling sandstone and shale uplands away from waterways

Landtype Associations are:

- __-A = Bottomlands/floodplains
- __-B = Badlands
- __-C = Prairie (or residual prairie) weekly dissected
- __-D = Prairie (or residual prairie) moderately dissected
- __-E = Strongly dissected lands
- __-G = Strongly dissected mountain slopes around buttes
- __-H = Plateau, prairie remnant, stream terrace remnant
- __-I = Plateau, tablelands, and interspersed badlands
- __-AD= Low relief pluvial/fluvial landscape, aggraded badlands

TABLE M-4

Summary of Landtype Association by Management Area for NFS lands in the Cedar River NG portion of the Project Area

NFS MA[1]	P2-A	P2-C	P2-D	P2-E	P2-G	P2-AD	P3-A	P3-AD	P3-B	P3-C	P3-D	P3-E	P3-F	P3-G	P3-H	P3-I	P11-A	P11-B	P11-C	P11-D	P11-E	P11-G	TOTAL
B	5	1410	4280	890																			6585
C				15		160																	175
TOTAL	5	1410	4280	905		160																	6740

[1] National Forest System Lands Management Areas. Unlike Table M-3, this table only shows NFS lands by landtype association. The analysis conducted for the Cedar River area only included NFS lands, as all other Federal minerals were included in the 1897 BLM Resource Management Plan.

The first letter and number indicate the Subsection represented. The third letter in the code indicates the Landtype Association within the Subsection.

Subsections are:

A2-__ = Alluvial floodplains
P2-__ = Dissected shale and sandstone plains
P3-__ = Shale badland areas along the river valleys
P11-__ = Rolling sandstone and shale uplands away from waterways

Landtype Associations are:

__-A = Bottomlands/floodplains
__-B = Badlands
__-C = Prairie (or residual prairie) weekly dissected
__-D = Prairie (or residual prairie) moderately dissected
__-E = Strongly dissected lands
__-G = Strongly dissected mountain slopes around buttes
__-H = Plateau, prairie remnant, stream terrace remnant
__-I = Plateau, tablelands, and interspersed badlands
__-AD= Low relief pluvial/fluvial landscape, aggraded badlands

TABLE M-5

Lands Acquired through the Bankhead-Jones Farm Tenant Act of 1937 by Surface Ownership on NFS lands for the SLM Portion of the Project Area[1]

Ownership	Acres
B	177,810
C	9,180
D	60,570
E	610
L	550
Total	248,720

[1] Based on March 24, 1994 GIS output.

TABLE M-6

Lands Acquired through the Bankhead-Jones Farm Tenant Act of 1937 by Surface/Mineral Ownership on NFS lands for the SLM Portion of the Project Area[1]

Ownership	Acres
Federal/Federal	218,170
Federal/Private	30,550
Total	248,720

[1] Based on March 24, 1994 GIS output.

APPENDIX N

SUMMARY OF AMENDMENTS TO THE CUSTER NATIONAL FOREST PLAN

SOUTHERN LITTLE MISSOURI AND CEDAR RIVER NATIONAL GRASSLANDS EIS

APPENDIX N

Approved Forest Plan Amendments

No.	Description	Date Approved
1	Includes "Uniform Format for Oil and Gas Lease Stipulations" in the Forest Plan	03/29/91
2	Adds Wild/Scenic/Recreational River Forest-wide Management Standards to the Forest Plan	12/15/89
3	Corrects table on page 49 that identifies key wildlife habitat by Ranger District and species of concern	03/29/91
5	Eliminates oil and gas production as a monitoring item	03/29/91
6	Changes the wording that allows camping in the administrative site at Meyers Creek Station on the Beartooth District	03/29/91
7	Changes the budget as displayed on page 163	03/29/91
8	Includes management standards and guides in response to the passage of the Federal Cave Resource Protection Act of 1988	03/29/91
9	Makes Dutchman's Barn, Long X Divide, Twin Buttes, and Blue Buttes not administratively available for oil and gas leasing	10/24/91
10	Changes the visual classification from partial retention to retention for certain areas surrounding Theodore Roosevelt National Park	10/24/91
11	Includes the Ferruginous Hawk as a sensitive species in North Dakota	10/24/91
12	Changes the dates for protection of prairie grouse dancing grounds from 3/1-4/15 annually to 3/1-4/30 annually	10/24/91
13	Management standards changed for Woody Draws (Mgt Area N) to require a "No Surface Occupancy" (NSO) stipulation	10/24/91
14	Removes 459 acres from the suitable timber base on the Sioux Ranger District	05/21/93
16	Adds definitions of "Existing Visual Condition" to the Forest Plan	05/21/93
17	Adds the name of Whitetail Area to the list of Management Area Cs	05/21/93
18	Revises table on pages 77 and 78 of the Forest Plan to reflect the current status of RNAs and SIAs	05/21/93
23	Corrects the list of Ranger Districts at the top of page 80 of the Forest Plan showing where MA M occurs	06/93
26	Incorporates a lists of Recreation Residence Tracts into the Forest Plan	Correction 01/94
27	Adds a list of plants, animals and fish that are sensitive in Montana	06/93

Proposed Forest Plan Amendments

No.	Description	Status
19	Changes the O&G administratively availability decision for portions of the Beartooth District	On hold in BT O&G ROD
20	Updates the Key Species/Critical Timing Periods found on page 19 of the Forest Plan	On hold in BT O&G ROD
21	Removes the area-wide NSO requirement for MA C Line Creek and replaces it with the stipulations identified in the selected O&G leasing alternative	On hold in BT O&G ROD

Amendment 4 has not yet been approved. Amendment 15 was withdrawn from further consideration in 1993. Amendment 22 was withdrawn pending further analysis, and Amendment 25 was incorporated into proposed Amendment 20, both in 1994.